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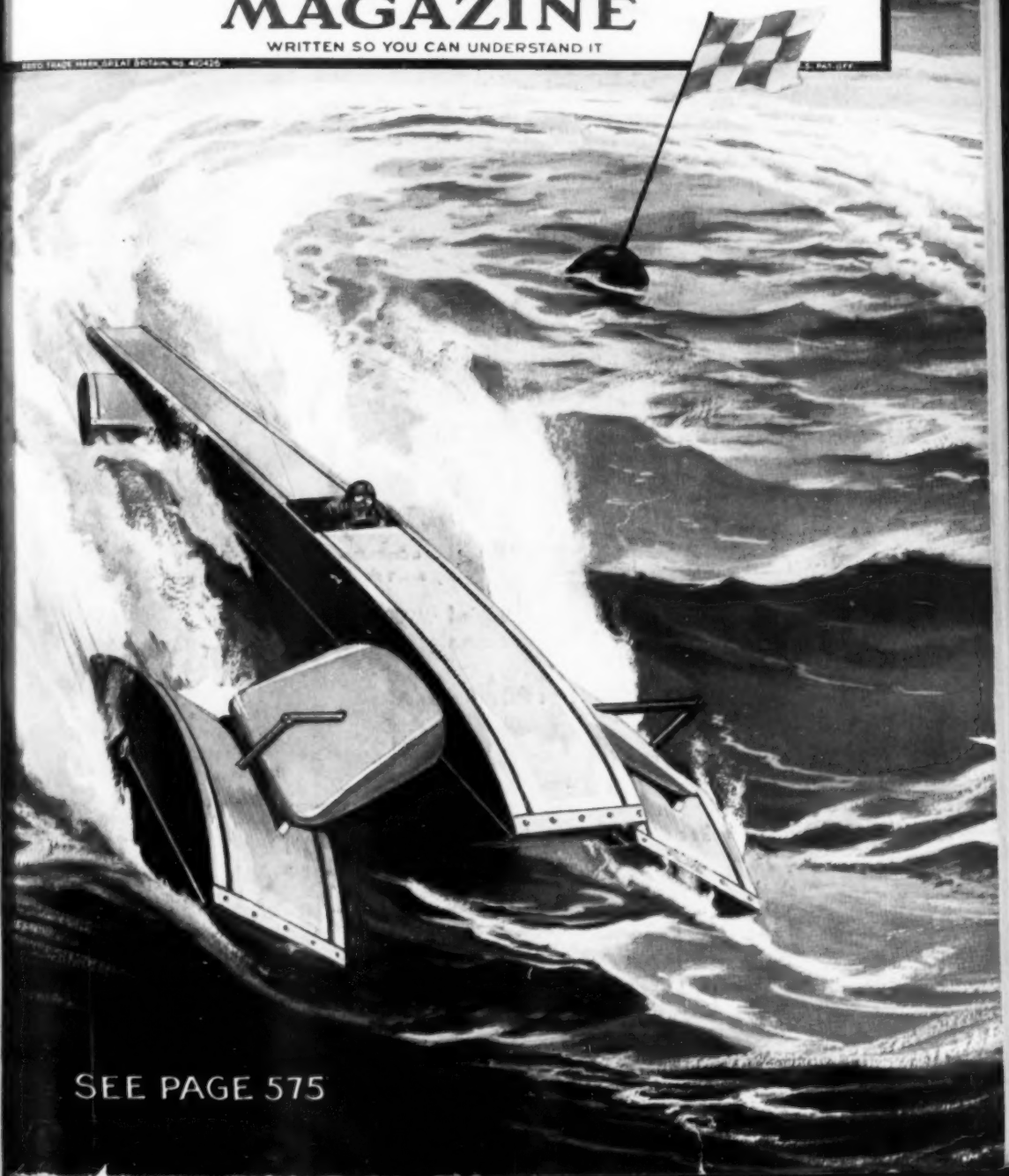

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WHY FAMOUS MEN OF THE DAY USE BARBASOL

Barbasol is the Headliner Shave

● *Barbasol testimonials are not paid for*

. . . a quick, clean act . . . with a "wow" finish

Jesse Crawford, musician extraordinary; wizard of the mo picture pipe organ; creator of musical novelties and "effe He's a featured artist at the great Paramount Theatre on Br way these days, where he is charming thousands daily.

✻ *"We're all showmen—behind the lights or on the stage of life—and that's why the Barbasol shave is best for the boys who have to take the spotlight, whether in big business or in the show business. Barbasol's a real trouper—no fuss, no trouble, no brush, no rub, or lather. And how quick and clean the razor gets through its routine. And, man, what a fine finish! I give it a big hand."*

Jesse Crawford

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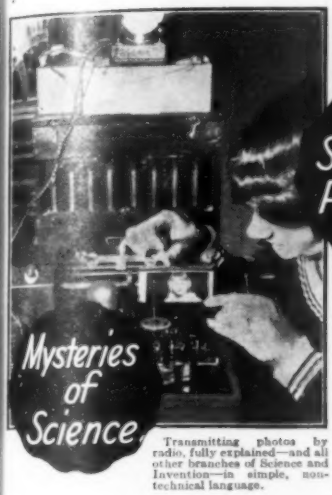

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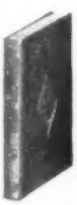

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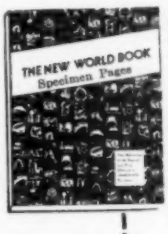

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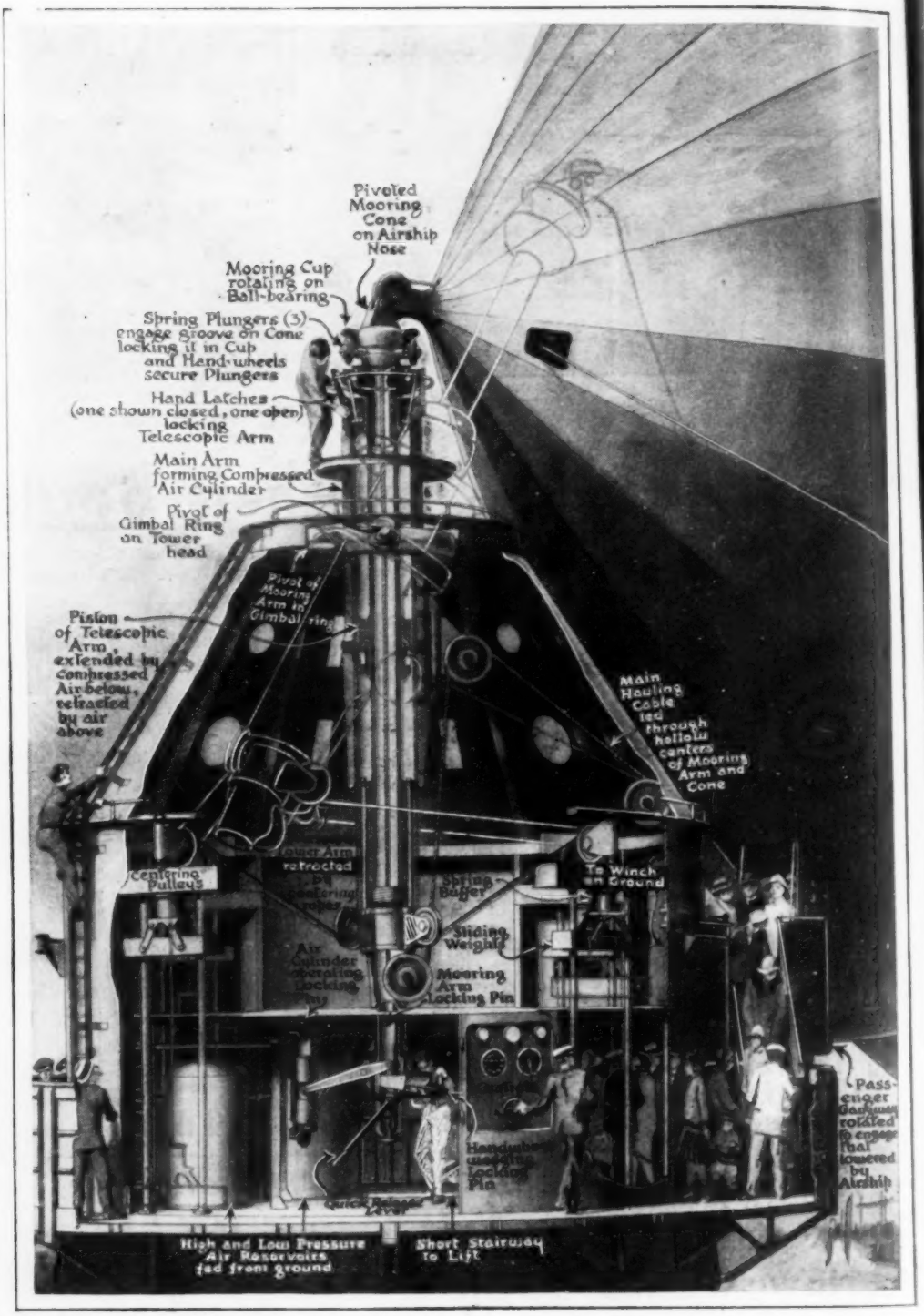
Pivoted Mooring Cone on Airship Nose
Mooring Cup rotating on Ball-bearing
Spring Plungers (3) engage groove on Cone locking it in Cup and Hand-wheels secure Plungers
Hand Latches (one shown closed, one open) locking Telescopic Arm
Main Arm forming Compressed Air Cylinder
Pivot of Gimbal Ring on Tower head
Pivot of Mooring Arm in Gimbal ring
Piston of Telescopic Arm, extended by compressed Air below, retracted by air above
Main Hauling Cable led through hollow centers of Mooring Arm and Cone
Centering Pulleys
Lower Arm retracted by centering ropes
Spring Bolger
To Winch on Ground
Sliding Weight
Air Cylinder operating Locking Ring
Mooring Arm Locking Pin
Passenger Gangway rotated to engage Mast lowered by Airship
Handwheel operating Locking Pin
Quick Release Lever
High and Low Pressure Air Reservoirs fed from ground
Short Stairway to Lift

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Where the "R-100" Rested When in Montreal: Artist's Drawing of the Mooring-Tower Head at St. Hubert; the Mechanism Is Operated by Compressed Air—See Page 630

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Breaking the World's Blind Flying Record

Captain Page Wearing Headphones Which May Be Plugged into Radio Receiver, and Holding Reed Visual Indicator Which Is Also Connected to Receiver and Gives Light Signals to Aid in Keeping on Course

By CAPTAIN ARTHUR PAGE, U. S. M. C.

HOW does it feel to fly blind for over a thousand miles on a blistering-hot day, when your life depends entirely on your familiarity with directional instruments and radio equipment?

This is the question many of my friends have been asking me ever since I broke the world's record the other day by flying blind in a hooded-in cockpit over the radio-controlled airways from Omaha, Nebr., to Washington, D. C.

Such a trip involves its share of drama and, perhaps, a surprise or two. Imagine, for instance, my feelings when, after flying safely over the treacherous Allegheny mountains and finally feeling the welcome sod of the naval air station in Washington under my feet, I was informed that I had flown over a terrific storm shortly after passing Cleveland. My companion, Lieut. V. M. Guymon, also of the marine corps, who rode behind me in an open cockpit, tells me that the visibility was reduced to zero and that probably only a radio control brought us through.

The major aim of the flight was to test out the value of a new type of radio apparatus, designed to help keep a pilot on his course during the worst conditions of black night, fog, rain or snowstorm. De-

veloped after many months' research by experts of the department of commerce, this is known as the reed type of visual indicator.

I also carried the standard type of radio apparatus, consisting of a six-tube receiver to which I could plug in a pair of lightweight earphones. This is called the "aural type" and indicates the flyer's position by means of two coded signals, an N (dash-dot), and an A (dot-dash), which the earphones readily pick up. When on one side of the course, the N is louder; on the other side the A is louder, while, when the pilot is on his true course, the two signals merge into an easily recognizable long dash.

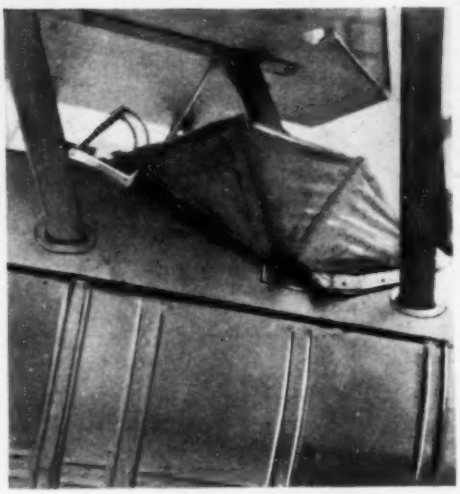
My take-off from Omaha was made while I was sealed in the cockpit at 6:00 a.m. and exactly at 6:45 that night I arrived at the Anacostia air station. Lieutenant Guymon's only maneuvers were the landings at Chicago, Cleveland and Anacostia.

After we had refueled, I made my final blind take-off from Cleveland and began the last lap of my journey. And now the fun began! Since there is no radio beacon pointed toward Washington from Cleveland, I was able to try out the new visual radio system and direct my course all the way to the Capital City thereby.

A rugged little box mounted on the instrument board and electrically connected with the receiving set, replaced the aural system.

The picture conveyed to the flyer by this indicator consists of two white vertical ribbons, varying from an eighth of an inch to a quarter of an inch in length. When the two lines are equal in length, the plane is on its course. A deviation to the left increases the vibration of the left reed or white line and reduces the other reed. A deviation to the right increases the vibration of the right white line, meantime reducing the other line. In a word, the longest reed, or the deepest white line, shows the side of the course on which the airplane is traveling.

This reed system works admirably, far better, I believe, than the standard, or aural system and promises much for safety of aviation.



Captain Page and Lieut. V. M. Guymon; Hooded-In Cockpit, and Captain Page after Finishing His Flight

MILLIONS OF CANDLEPOWER FOR NIGHT BASEBALL

Wrigley Field, Los Angeles, during a Night Baseball Game; the Diamond Is Lighted by 144 Floodlights Yielding 40,000,000 Candlepower, Making the Field Almost as Light as Day

Night baseball is increasing in popularity since the innovation was introduced, and Wrigley field, Los Angeles, now has a night baseball plant that outshines Broadway in illuminating brilliance. The field is equipped with the most complete lighting installation of its kind in the country, the spectators being afforded a view almost as good as in daylight. The field is lighted by 144 floodlights, yielding more than 40,000,000 candlepower.

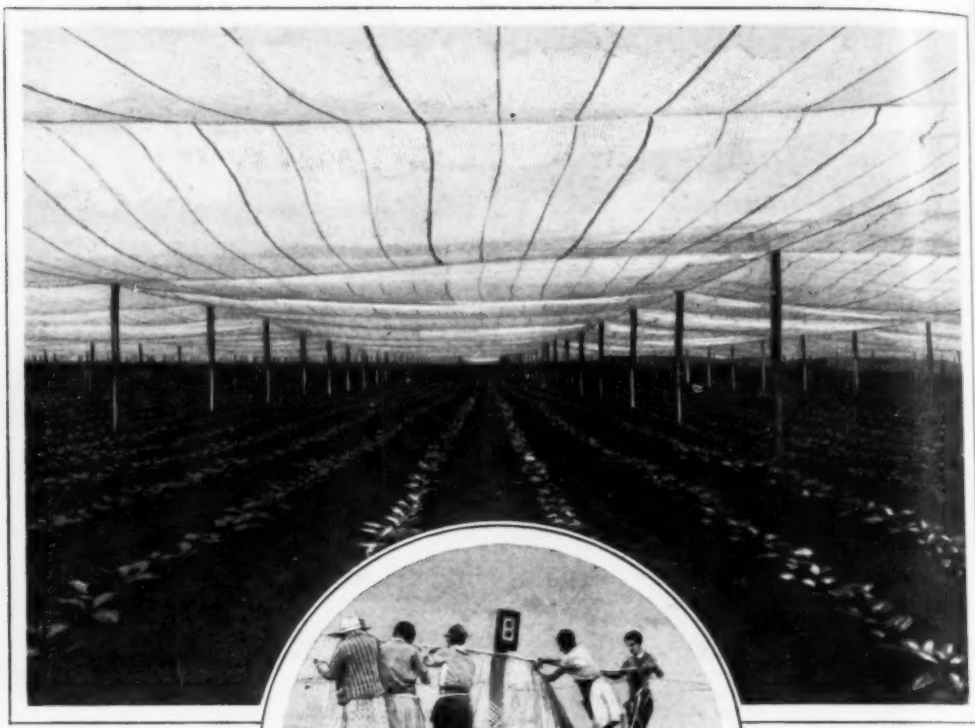
FINGER NAILS SHOW STAGES OF SERIOUS DISEASE

The condition of the finger nails of tubercular patients is an index to the progress of the disease, according to a well-known physician. Pitted nails were found in every one of fifty cases of the disease, while the same number of ex-patients and normal persons had smooth nails, and only three cases of pitted nails were found among those having inactive tuberculosis. Downward curving of the nails and extreme blueness are also symptoms of the malady, the doctor asserts. This correspondence between the appearance of the nails and the condition of the lungs is said to have been recognized first by the ancient Greek physician Hippocrates, the "Father of Medicine."

POTATO PEELER LIKE A GRATER REMOVES SKINS EASILY

Operating on the principle of a grater, a potato peeler which quickly and easily removes the skins is now available as an aid to the busy housewife. It consists of a bowl with grated sides in which the potatoes are placed and a mechanical arrangement operated by a crank, the turning of which causes the grated sides to rub off the skins.

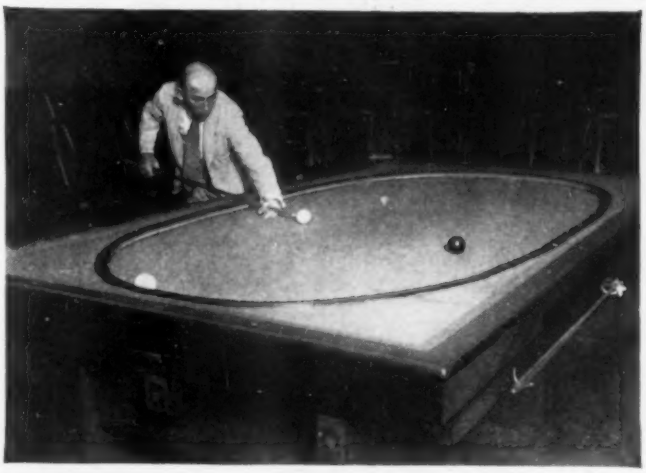
BRINGING THE TROPICS TO CONNECTICUT VALLEY



Tent, over a Connecticut Tobacco Field to Increase Humidity; Below, Placing One of the Tents in Position

A few years ago, a New England tobacco raiser stepped into a tent to seek relief from the burning rays of a hot summer sun. In the tent, he found an idea of how to bring the climate of the tropics—and many million dollars—to the Connecticut valley. For, as he wiped his brow, he realized that under the tent canvas was the sort of heat he'd been wanting for years, to enable him to raise the quality of tobacco that would bring the highest prices on the market—the dripping, moisture-laden heat of an equatorial jungle. The valley, he knew, had most of the requisites to producing a high-grade wrapping and binding leaf. The soil was just right, the summer temperature ran high enough and the season was of ample length. Just one item was lacking—high humidity—without which the finer leaves would burn and be valueless. He was certain that if he could reproduce the atmospheric condition obtaining under the tent canvas over a large area of tobacco land, he could raise the highest-grade leaf. That fall he ordered a supply of seeds of the finest Sumatra wrapper tobacco plants. The next spring he planted the seeds in hotbeds and, while they were sprouting, built a ten-acre tent. Instead of canvas, he used a loose-meshed fabric like cheesecloth, but heavier, the idea being to have a covering that would hold the humidity within and at the same time allow the moisture from rains to drip through. As soon as the first warm days arrived, the farmer set his young tobacco plants out under the big tent. It had cost

him a lot of money, but the idea worked out and he was well repaid. That winter he sold the tobacco raised under cloth for $3 per pound, while the remainder of the Connecticut valley outdoor crop brought 35 cents a pound. Since that day—and using the same method as that pioneer—the New England valley has become an important factor in the high-grade market. The tents are ten feet high and the fields covered vary from five to twenty-five acres. This season about 4,000 acres have been under cloth, a considerable increase over the area covered last year.



Oval Billiard Table Whose Rounded Ends Add to the Number of Possible Angles and Hence to the Number of Shots That Are Possible

OVAL BILLIARD TABLE OFFERS DIFFICULT SHOTS

Offering many more angles to be conquered than the rectangular table, an oval billiard table has been introduced by Charles Peterson, fancy-shot expert. The play on the oval table is the same as on a rectangular one, but it is more difficult because of the shape.

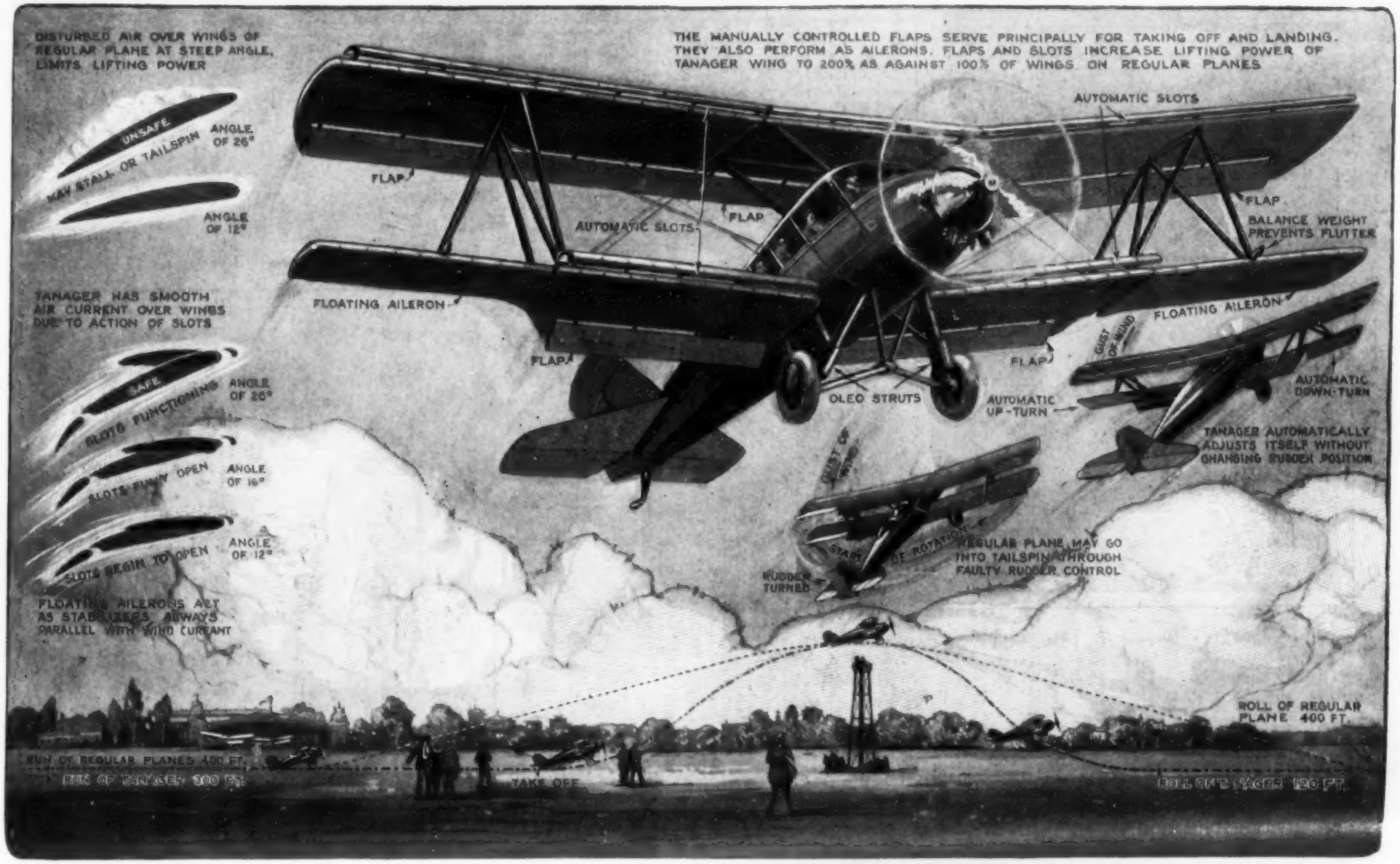
WATERPLANE AND SPEEDBOAT OFFER AQUATIC THRILLS

To give added thrills to aquatic sports, a waterplane has been made for towing behind a speedboat. The waterplane resembles a small amphibian and rests on pontoons. When pulled at high speed, the craft rises several feet above the water, but is designed to prevent the passenger being catapulted out in case of trouble.

Waterplane with Stubby Wings Which Is Towed behind a Speedboat; When Sufficient Momentum Is Gained, the Craft Rises from the Water

PHONE VOCABULARIES USED BY THE WORLD

Telephone vocabularies vary throughout the world. In London it is, "Are you there?" while Paris says, "J'ecoute." China says, "Day huey bin she ah?" Berlin says, "Bitte, nummer," and America, "Number, please." In London the hello-girl is a telephonist, in Paris she is just mademoiselle. China calls her "hom sin luey" and Berlin and New York refer to her as an operator. The proper term for operator in China is "Din wax sin gay sum," which means "someone who takes care of connecting."


DISTURBED AIR OVER WINGS OF REGULAR PLANE AT STEEP ANGLE, LIMITS LIFTING POWER
UNSAFE
MAY STALL OR TAILSPIN
ANGLE OF 25°
ANGLE OF 12°
TANAGER HAS SMOOTH AIR CURRENT OVER WINGS DUE TO ACTION OF SLOTS
SAFE
SLOTS FUNCTIONING
ANGLE OF 25°
SLOTS FULLY OPEN
ANGLE OF 16°
SLOTS BEGIN TO OPEN
ANGLE OF 12°
FLOATING AILERONS ACT AS STABILIZERS, ALWAYS PARALLEL WITH WIND CURRENT
THE MANUALLY CONTROLLED FLAPS SERVE PRINCIPALLY FOR TAKING OFF AND LANDING. THEY ALSO PERFORM AS AILERONS. FLAPS AND SLOTS INCREASE LIFTING POWER OF TANAGER WING TO 200% AS AGAINST 100% OF WINGS ON REGULAR PLANES
AUTOMATIC SLOTS
FLAP
FLAP
AUTOMATIC SLOTS
FLAP
BALANCE WEIGHT PREVENTS FLUTTER
FLOATING AILERON
FLOATING AILERON
GUST OF WIND
FLAP
FLAP
OLEO STRUTS
AUTOMATIC UP-TURN
AUTOMATIC DOWN-TURN
TANAGER AUTOMATICALLY ADJUSTS ITSELF WITHOUT CHANGING RUDDER POSITION
GUST OF WIND
START OF ROTATION
REGULAR PLANE MAY GO INTO TAILSPIN THROUGH FAULTY RUDDER CONTROL
RUDDER TURNED
ROLL OF REGULAR PLANE 400 FT.
RUN OF REGULAR PLANES 400 FT.
RUN OF TANAGER 300 FT.
TAKE OFF
ROLL OF TANAGER 120 FT.

Sketches of Curtiss "Tanager," Winner of the $100,000 Guggenheim Safe Plane Contest, Showing Floating Ailerons and Flaps and How It Performs on Take-Offs and Landings; Note How the Slots, Opening Automatically, Maintain a Smooth Air Flow over Wings at Steep Angles

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WINGS for ALL of US

© The Chicago Daily News

"The Blue Streak," Mighty Bellanca Tandem Plane with Pusher and Puller Propellers; Its Engines Develop 1,398 Horsepower, It Carries 2,150 Gallons of Gasoline and Has a Top Speed of 160 Miles an Hour

Sketches of Curtiss "Tanager," Winner of the $100,000 Guggenheim Safe Plane Contest, Showing Floating Ailerons and Flaps and How It Performs on Take-Offs and Landings; Note How the Slots, Opening Automatically, Maintain a Smooth Air Flow over Wings at Steep Angles

By CORLEY McDARMENT

THE time has come—almost—when you may say:

"I'd buy that baby with the robin's-egg-blue wings if I only knew how to fly," and the salesman will say:

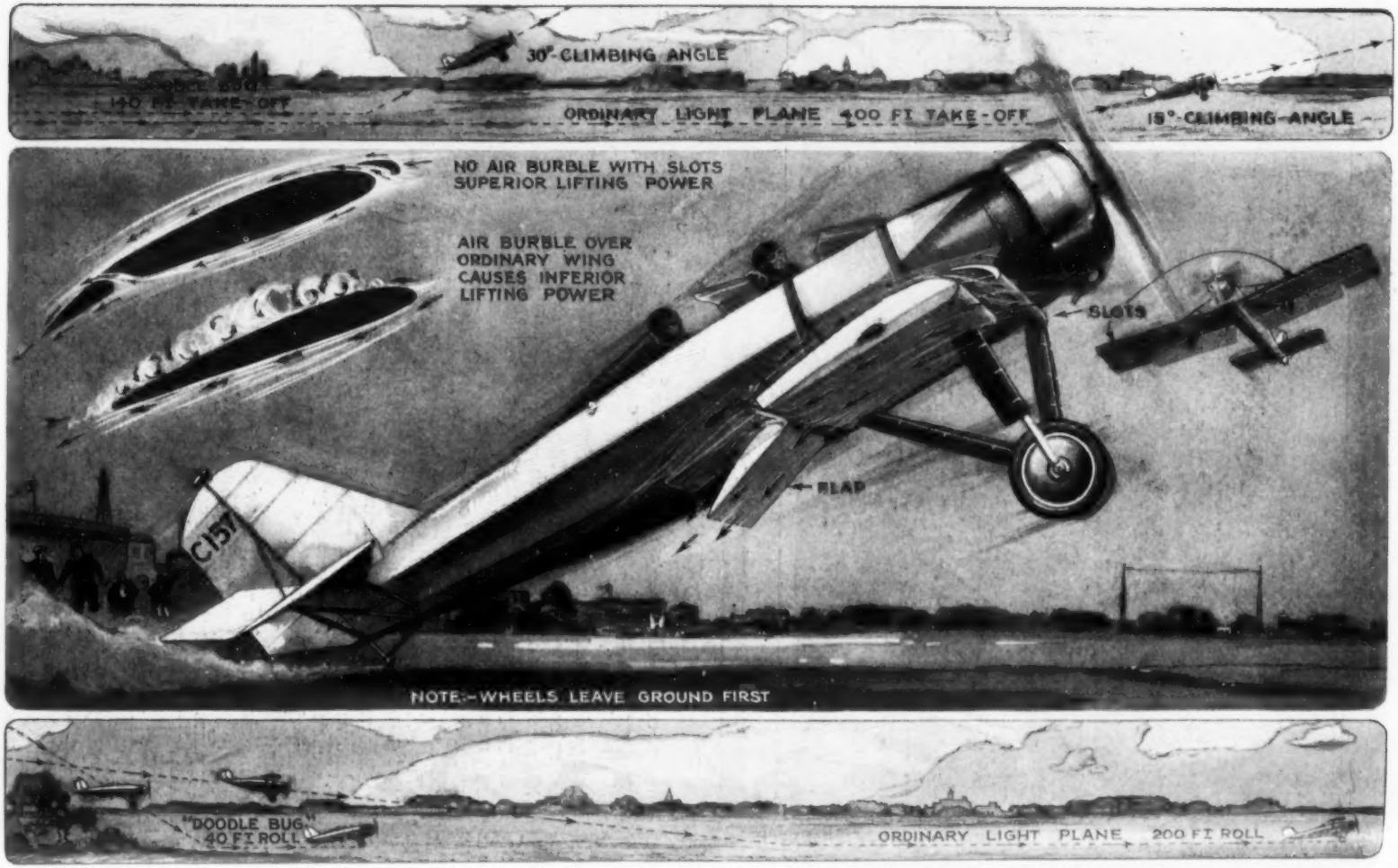
"If you have an hour to spare we'll teach you to fly it and you can fly it home, just like driving a new automobile home."

This is not a fanciful idea. It is something which has been slowly developing since the Wright brothers made their first flight. All of the old heads in the aviation game have known, and all big business men have known, that, unless airplanes became safe enough for the average person to fly them, their commercial use will be greatly limited.

It has been said that the war set aviation ahead forty years in performance but back twenty years in safety. Figures compiled by the government disclosed that human errors of judgment in the fine art of flying caused most of the fatalities. And then, in simmering down the human-error business, it was found that the errors were mostly around tail spins resulting from stalls in the air. It takes a "crack" pilot to fly one of the conventional type of airplanes which the lessons of the war have brought out. Any person who could not tell exactly when his speed dropped from sixty miles an hour to forty when he was inclosed within a cockpit, was just a "gone gosling." But this thing has changed.

Inventors have long known that a safe airplane must be produced if the average person is going to buy it. It has been the hope of airplane makers to produce a vast market like the automobile industry. So, after finding the cause of so many accidents, an intensive study started which not only included charts and wind-tunnel experiments but extended to the birds in the air. And from the birds the greatest lessons in flying have been learned.

At first the shape of the wings of birds was studied, but with careful copying of these wings, the same results that birds get could not be produced. Slow-motion pictures were studied, and long hours of observation in other ways were spent in trying to solve the secret of safety which birds possess. It was found that certain feathers in the wings play as important a part as the entire wing. The reason birds were studied so carefully was that



"The Doodle Bug," an Experimental Plane, Promises Wide Usefulness Because of Its Remarkable Flight Performances; It Combines Slots and Flaps and Has Been Flown Out of and Landed in a 150-Foot Circle; It Was Designed by J. S. McDonnell, Jr., and C. L. Zakh, Assisted by J. G. Cowling, Jr.

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they do not often get into tail spins and can land very slowly.

Finally, somebody came out with wing slots on the leading edge of airplane wings, then somebody else brought out flaps for the rear or trailing edge, and later came forth the floating aileron. The combination of these three things so nearly approximates the feather action in birds' wings that almost birdlike accomplishments became possible. Today the aviation world is standing aghast at the safety performances of airplanes built with these devices. Almost overnight they have revolutionized the industry, and planes are being brought out which almost anybody can fly. The dreaded tail spin has been removed from the realm of probability, and an unskilled pilot may level off for a landing 200 feet in the air and, with the automatic slots and floating ailerons, come in safely. A plane with a top speed of 112 miles an hour, landing speed of thirty miles, and aileron control at all speeds over ten miles, is a monument in aviation history.

Peculiar Aileron Control of German Thick-Wing Plane, and Sketch of Early Test with Balloon

Such an airplane makes its appearance, and it is only the beginning of safety and performance in flying. Wing slots, flaps and floating ailerons are the only safety devices made for airplanes since the first ailerons of the ordinary type were put on planes. Veteran pilots who have forgot their training days often wonder why more people cannot learn to fly. The trick seems so simple after once learned. The fact is that straight flying is simple and is easy to learn. The catch comes in the few little mistakes which may be so fatal. These mistakes occur when flying speed is lost in glides, climbs or turns. That

"The Doodle Bug," an Experimental Plane, Promises Wide Usefulness Because of Its Remarkable Flight Performances: It Combines Slots and Flaps and Has Been Flown Out of and Landed in a 150 Foot Circle. It Was Designed by J. S. McDonnell, Jr., and C. L. Zakb. Assisted by J. G. Cowling, Jr.

ORDINARY LIGHT PLANE 200 FT ROLL

40 FT ROLL

it takes a master to know exactly the right climbing and gliding angles is shown by the number of experienced flyers who have been killed each year by slight errors of judgment in this simple maneuver.

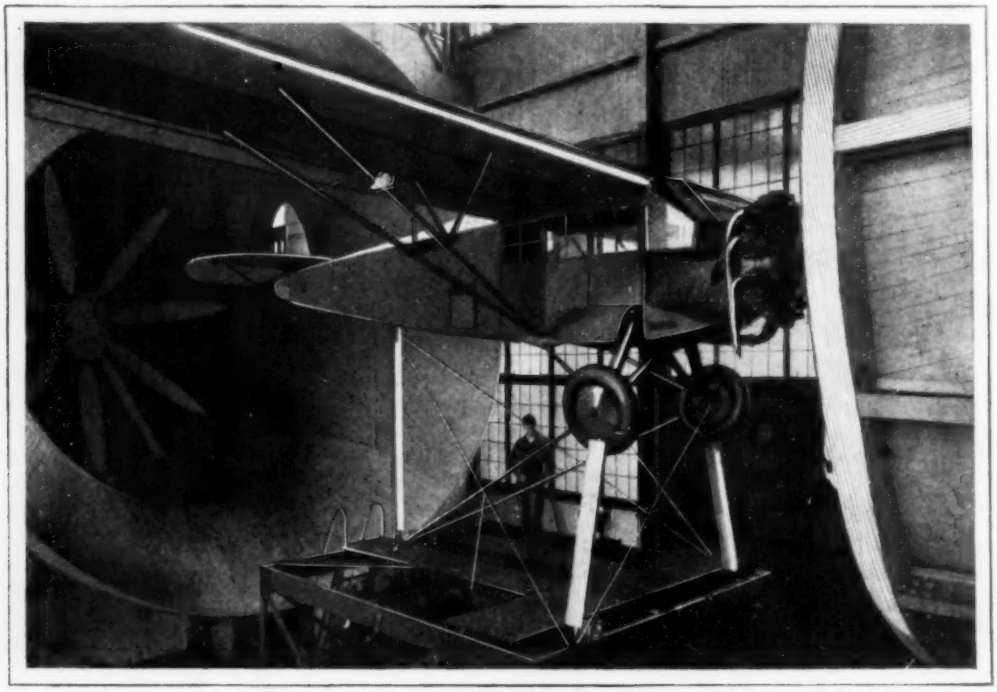
Most old pilots prefer to fly in an open cockpit where they can feel the rush of air upon their faces and thereby estimate the speed. When the rush of air gets less than the pilot knows from experience it should be, he quickly senses danger and pushes the nose of the plane downward to pick up extra speed. It takes a good man to tell when the air speed has dropped from sixty miles an hour, where an airplane may be controlled, to fifty miles an hour where the controls may be useless.

The new airplanes coming out make all fine distinctions of speed unnecessary. Airplanes will probably never become foolproof any more than locomotives or steamships are, and there will always be an element of danger. They will never be quite as safe as automobiles. Whenever a person is up in the air in a craft which has a motor and gasoline and wings, he will be subject to certain apparent dangers. The new safety planes cannot be exactly parachuted down. They land at about thirty miles an hour. In an airplane one can hit most anything at this slow speed and survive.

The parachute is the safest of all aerial vehicles. A parachute with a motor would be ideal for safety, but would have little performance. The new airplanes, however, are using the parachute principle. The parachute owes its efficiency to the big inside curvature of silk. The greater the curvature up to a certain limit, the greater the efficiency. Slots and flaps increase this curve.

The trouble with too much curvature in a wing is that it cuts down the speed. If it were not for this, all planes would have highly curved wings. The wing flaps on the trailing edge of wings, however, fit into the streamlining in normal flight and do not retard motion through the air. The flaps may be depressed by a handle or lever when needed for a landing.

The floating aileron is a new idea of the manufacturer who builds a plane using them. These ailerons look awkward, but they appear to be highly efficient. They



Accurate Tests of a Plane's Performance Are Obtained before Flights in the Wind Tunnel, Where Flying Conditions Are Simulated; Experiments Here Have Done Much to Develop Streamlining

A Late Offering from Germany toward More Stable Planes; This One, Known as the "Duck" Model, Has Its Tail in Front, and the Motors Are under the Wings

float in the windstream and are free from the burble of the ordinary aileron. The ordinary aileron may throw a plane in a spin under certain conditions, but the floating ones cannot do it.

The new planes are so safe that it is possible for a man to "read up" on them and think a lot about how to operate them and, with only a few minutes' instruction, be able to fly after a fashion. They are going to bring to the average person all the fascination, thrill and convenience of flying. Motors have now been so refined that they will run for hundreds of hours without stopping. Motor failure is a rare thing these days. And the expense of planes is coming down. The new planes are to be kept within the range of automobile pocketbooks. With the Diesel engine making its appearance in the aviation world, the power plant for planes will become safer from fire and ignition troubles, and fuel cost will be greatly reduced.

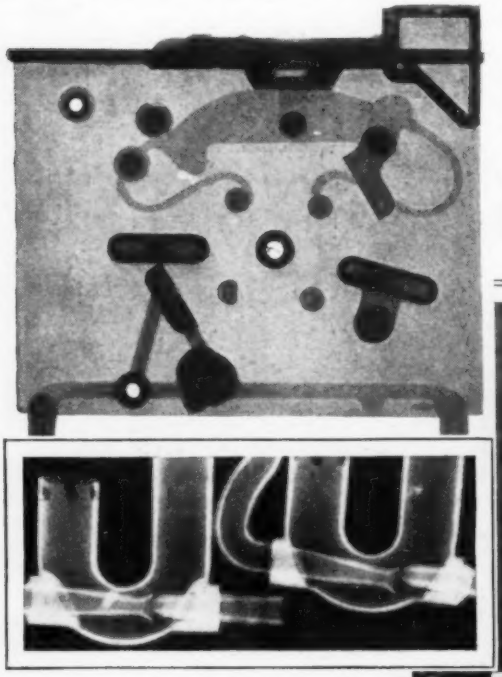
The wear and tear on an airplane in the air is almost negligible. A metal airplane should last many years, or until bolts and pins wear through. With welding on such an efficient standard, a metal plane should last almost indefinitely. A motor may run 500 hours without overhaul; any airplane will outlast many motors, and with the usual speed of 100 miles an hour, a man may fly 50,000 miles before overhaul of his motor.

All this means that the airplane now is adapted to the needs of the public.

COWS FED YEAST TO IMPROVE MILK FOR INFANTS

Yeast which has been exposed to ultraviolet rays has been found better than cod-liver oil for increasing the rickets-preventing properties of cows' milk intended for infants. Investigators of the Wisconsin agricultural experiment station observed that summer milk had slightly more of vitamine D, the rickets preventive, than winter milk because the cows were getting more ultraviolet light in summer. Next, experiments with the cows' diet were started. Cod-liver oil, which prevents rickets in man, was not satisfactory for cows because, when fed in large amounts, it lowered the secretion of butter fat, and when fed in small doses, it produced little effect. Two hundred grams of irradiated yeast to a cow producing from thirty to forty pounds of milk, however, increased the vitamine content of the milk manyfold. Thus, with yeast, the vitamine content of milk can be controlled at small cost. Its application for the enrichment of human milk still remains to be worked out.

MANY NEW USES FOUND IN INDUSTRY FOR X-RAYS



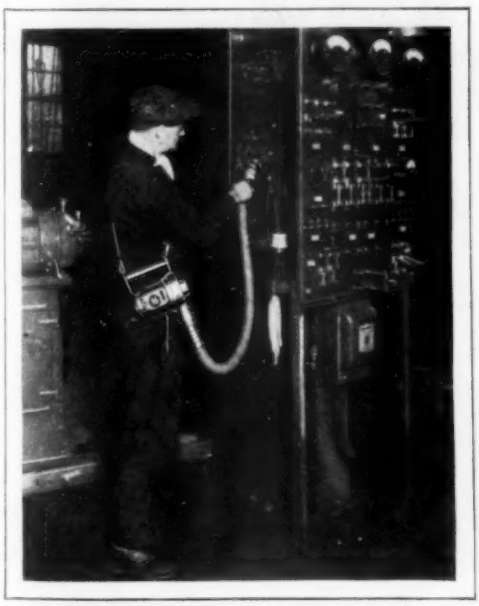
X-Ray of a Die Casting, and Incorrect Assembling of Hard-Rubber Siphons Shown by X-Ray; Right, X-Raying a Camera

In the construction of a large Massachusetts power plant, it was decided to have X-ray examinations made of all the pipe and fittings for the high-pressure steam line. As a result, some of the parts, which would have been accepted under any other test, were found to be defective and were rejected. Thus the power company obtained definite assurance that the equipment was safe and could be operated continuously, without the possibility of an early shut-down for repairs. Industry is finding that there is as much need for X-ray examination of the interior of metal castings, essential parts of automobiles, airplanes, welds, munitions, etc., as of the human body, for they are equally susceptible to internal ills that might lead to serious results. Welding of materials is now practiced extensively in all fields of industry, and is an art where the skill of the workman has much to do with the effectiveness of the weld. The X-ray is now being employed to locate defective welds, and thus is playing an important part in adding to our safety. In the rubber industry, golf balls are being X-rayed to determine the symmetry and correct positioning of the hard-rubber core. One of the rubber companies has made examinations of its tires to determine the union between the rubber and the cord. This is done by filling the cord with some lead salts which make them opaque to X-rays. A large eastern manufacturing company is using the rays to examine its metal radio-transmission tubes. Each tube is X-rayed twice, the positions differing by ninety degrees to assure that there is correct spacing between the grid and the filament. The presence of metallic particles in electric insulators often causes trouble on high-voltage lines and the X-ray is proving a big aid in its detection. Cables, heavily insulated wire, and all hidden and concealed wiring often require examination, and the X-rays offer the easiest way to do it; they also are used to determine the diameter of capillary metal tubing. Much information is being gained about any abnormalties in the structure and grain of high-grade wood by means of X-ray ex-

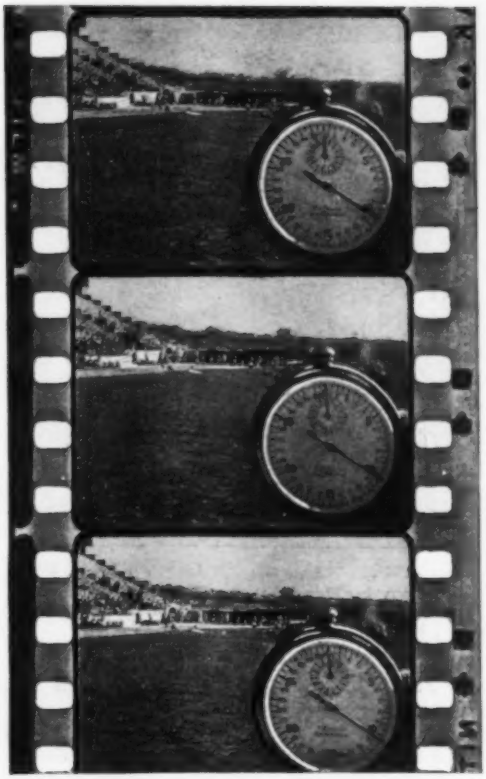
aminations. The detection of knots, resin pockets, grubholes, etc., is very important if the wood is to be used in fine furniture. The late discovery of these spots, after much labor had been done, would mean a distinct loss, for the piece would have to be discarded. Such examination is also very important if the wood is to be subjected to strain. Fire brick is being examined with the X-ray to detect hidden cracks and flaws and metallic particles.

VACUUM HELPS CLEAN MOTORS AND SWITCHBOARDS

Blower and vacuum cleaner have been combined in a single unit that not only provides powerful suction for cleaning autos, bins or other restricted interiors, but also furnishes a blast of air for blowing dust and dirt from places ordinarily inaccessible, including parts of automobiles and electrical equipment. The apparatus is changed from vacuum cleaner to blower by removing the dust bag and changing the location of the hose. By hanging motor, fan and dust bag from the shoulder or a convenient hook, the operator gains access to spaces that otherwise could not be reached without handling of materials. The body of the cleaner is of aluminum, thus making it light in weight.



Portable Vacuum Cleaner Slung from the Shoulder; It Also Can Be Employed as a Blower



Movie Film of Sporting Event, and Split-Second Watch Used with Camera to Time the Race

RACE TIMED BY MOVIE CAMERA FOCUSED ON WATCH

Eliminating the human element from the accurate timing of races, a movie camera and split-second watch were used together recently in timing relay races at Ohio State University. The movie camera was mounted on a board and focused, by means of a special lens, on both the runners and the watch, the special lens being situated between camera and watch. The camera is trained toward the start of the race and the smoke puff from the starter's gun is shown on the film, the time of starting being recorded simultaneously by the watch. The camera then follows the runners down the course, taking a picture of the finish with the watch recording the time. The difference in time shown between that indicated on the picture with the puff of smoke and that on the picture of the finish is the correct time for the race, and a complete picture of the event also has been taken.

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Ice Frozen in Thin Sheets and Segregated in Small Blocks So It Can Be Broken with Fingers

ICE FROZEN IN SMALL BLOCKS IS BROKEN WITH FINGERS

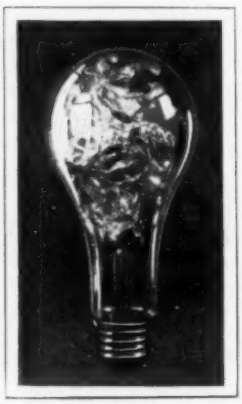
Ice, segregated in small sheets like a cake of chocolate, can be broken as easily with the fingers as the confection, thus eliminating the need for a mallet and containing bag. For such freezing, a special tray is used, the bottom containing grids and the ice being frozen in quarter-inch sheets. This makes it very easy to handle, as there is no splintering.

SPONGE DIVERS FIND MILLION DOLLARS ANNUALLY IN SEA

Greek divers with headquarters at Tarpon Springs on the west coast of Florida annually bring from the bottom of the Gulf of Mexico sponges worth about $1,000,000. The work is hazardous, since a shark may foul the air lines or a barracuda attack a diver. In addition, those who remain long at the task are subject to the "bends," a paralytic condition occasioned by air and water pressure. The boats often stay out for two or three months before coming in with their foul-smelling cargo. The diver plies his trade with a three-pronged hook attached to a stick. He hooks the sponges and places them in a net which is raised and another lowered when he has filled it. The commercial sponge is the skeleton of an animal which has adhered to the bottom of the sea or to submerged surfaces. When brought from the sea, it is hard and covered with a tenacious black skin, while gelatinous gray matter fills the pores. This gray matter is allowed to decay and is pressed out, after which the sponges are soaked in permanganate of potash to give them the tan color. A sponge's age is reckoned by its breadth, one one-eighth of an inch in diameter being about eighteen months old. Four varieties are found in the Gulf of Mexico, the best quality being the sheep's-wool sponge which is more durable. Twice weekly auctions are held, one day's sale often amounting to $50,000.

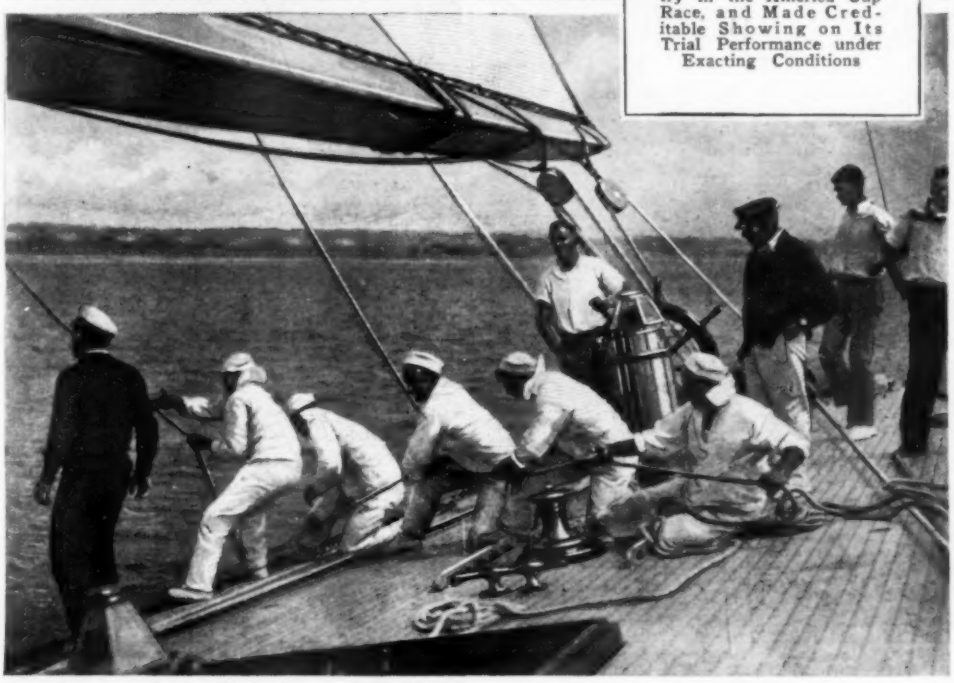
ELECTRIC PHOTO FLASH LAMP ENDS SMOKE AND NOISE

A fireless, smokeless, odorless and noiseless photographic flash lamp has been developed by the General Electric company. Requiring only a one-hundredth of a second to act, and being without hazard, it will make possible the taking of flashlight photographs in places heretofore practically impossible to "shoot," as in trains, airships and theaters, under water, and by insurance companies requiring night photographs under all weather conditions. The lamp consists of a clear bulb of standard design, with the flashlight filament coated with a special preparation and with a quantity of very thin aluminum foil in crumpled sheet form within the bulb. The bulb is oxygen-filled. When the circuit is closed, the filament is lighted and this, in turn, lights the foil. The lamp operates on any 115-volt house supply, or with dry, storage or flashlight batteries. A new lamp is needed for each flash, and a suitable reflector equipment should be used with it.



SCENES ON BOARD AN AMERICAN CUP DEFENDER

The "Yankee" on a Test Run off Oyster Bay, Long Island; Above, Crew Hoisting the Mainsail by Means of Halliards Run through the Hollow Mast and below Deck; Below, a Deck Scene during the Run; the "Yankee" Is the Boston Syndicate Entry in the America Cup Race, and Made Creditable Showing on Its Trial Performance under Exacting Conditions



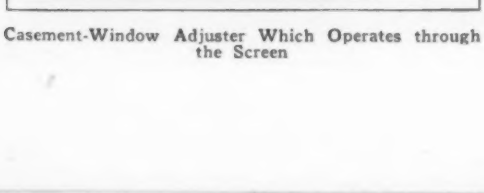
Microphone in Top of Bank Vault Which Sets Off a Police Alarm at Any Slight Noise

MICROPHONE IN A BANK VAULT SOUNDS POLICE ALARM

As a burglar alarm, a microphone has been installed in a Chicago bank vault and connected to police stations. The microphone is smaller than those used in broadcasting, but so sensitive that the slightest noise causes it to function. It is expected to prove useful in case someone is accidentally locked in the vault, as well as in the event of attempted robbery.

CASEMENT-WINDOW ADJUSTER WORKS THROUGH SCREEN

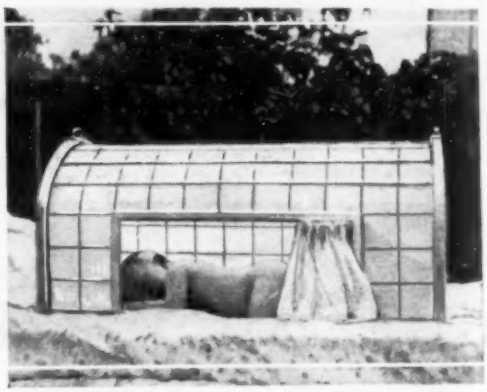
Operating through a screen without catching or binding, a casement-window attachment adjusts the window at any desired angle and holds it firmly in that position. A small curved metal rod extends through a notch at the bottom of the screen. To the window sill is attached a clamp in which the rod is held by a thumbscrew. The curved rod is jointed, and when the window is closed, a hinge allows it to fold down against the wall out of the way.



Casement-Window Adjuster Which Operates through the Screen

CLAM-SHELL SOLARIUM ADMITS ULTRAVIOLET RAYS

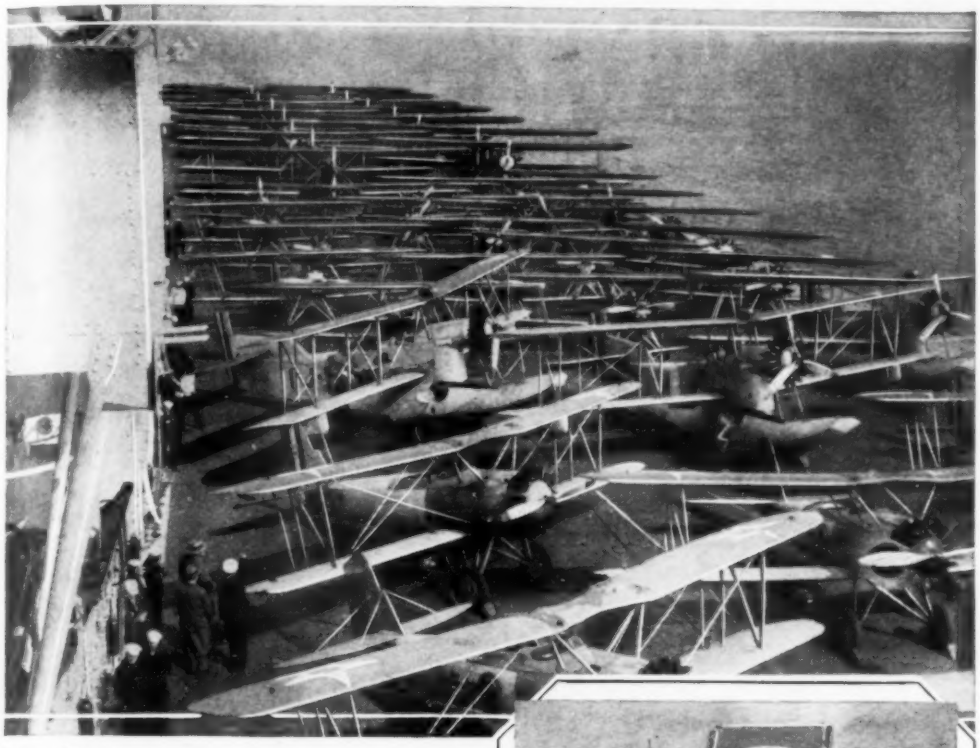
Clam shells are being used to construct roofs, solariums, greenhouses, canopies and porches since it has been discovered that the underside of the clam's shell, which is translucent, freely admits the ultraviolet and infra-red rays of sunlight. From the shells, canopies for the baby's sun bath are being made, to allow exposure to the ultraviolet rays without at the same time exposing the infant to wind and other discomforts. The material is non-shatterable, and it is claimed that it is stronger than window glass, although no more expensive. It is light in weight and resists the deteriorating effects of sun, rain and weather over a long period. Being opaque, it is of value in making covers for hospital beds, thus allowing patients to enjoy sun baths in private, and this quality also makes it adaptable for greenhouses, since it cuts out the glare.

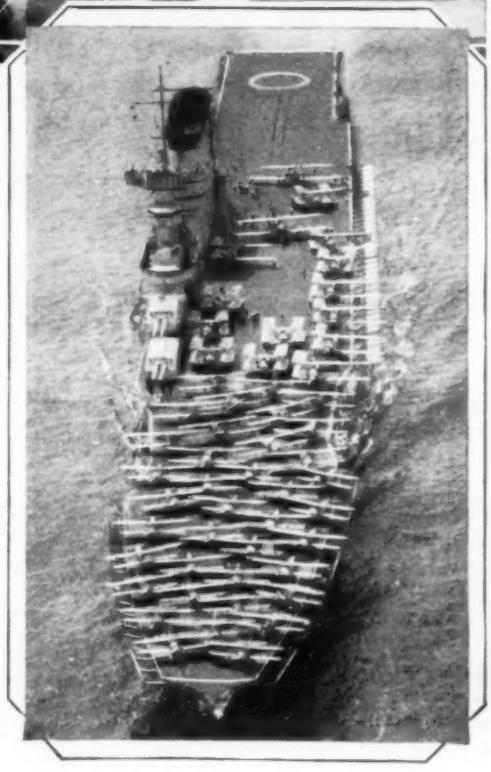


Solarium for the Baby, Made from Clamshells Which Admit the Sun's Ultraviolet Rays

A world's record of 49.7 miles per hour for outboard motorboats was made recently at Fox Lake, Ill., by Ray Pregenzer.

SIXTY NAVY PLANES "BATTLE" WITH MOTHER SHIP





© Henry Miller

Two Views of Navy Planes on the Deck of the Airplane Carrier "Lexington" during Maneuvers

More than sixty navy planes participated in large-scale aerial maneuvers off the Virginia coast, staging a mimic battle with the "Lexington," the airplane carrier that serves as mother ship for the war birds. Sixty-nine planes were sent off the deck of the "Lexington" at intervals of ten seconds, and, when all were in the air, they staged an attack on the boat, the "battle" lasting for three hours before hostilities were called off and the fighting planes settled back on the deck.

SALMON SWIMS 1,300 MILES

Evidence that an Alaskan salmon swam 1,300 miles in forty-four days indicates the distance that certain species of fish travel, according to the bureau of fisheries. This individual fish, which had been tagged with a metal marker by the bureau in Alaska, was caught in a Siberian stream 1,300 miles away.

The Secrets of Davy

Rescuing Members of the Crew of British Steamer on Rocks in Bay of Biscay

© The London Times

By HAROLD T. WILKINS

STRANGE stories of vanished ships and vain searches by airplanes, liners and warships scouring the seas from Capetown to Cape Horn and Frisco, in the attempt to solve marine mysteries, continue to puzzle the sleuths of Lloyd's, the famous shipping corporation of the Royal Exchange, London.

Not a month goes by without the name of some missing boat being added to the files in Lloyd's ships' "graveyard." At the present moment, there are half a dozen first-class mysteries of missing ships of European ownership alone which have vanished on the high seas in 1929 to 1930.

Despite directional wireless, radio lighthouses and compasses, and beam-radio navigation, the sea retains all its elements of mystery and danger. The red-robed caller still mounts the rostrum at Lloyd's and rings the bell of the lost "Lutine," tolling the unknown fate of some good ship of which no news has reached any of the world's ports for many months since she left her home port. Yet, of all

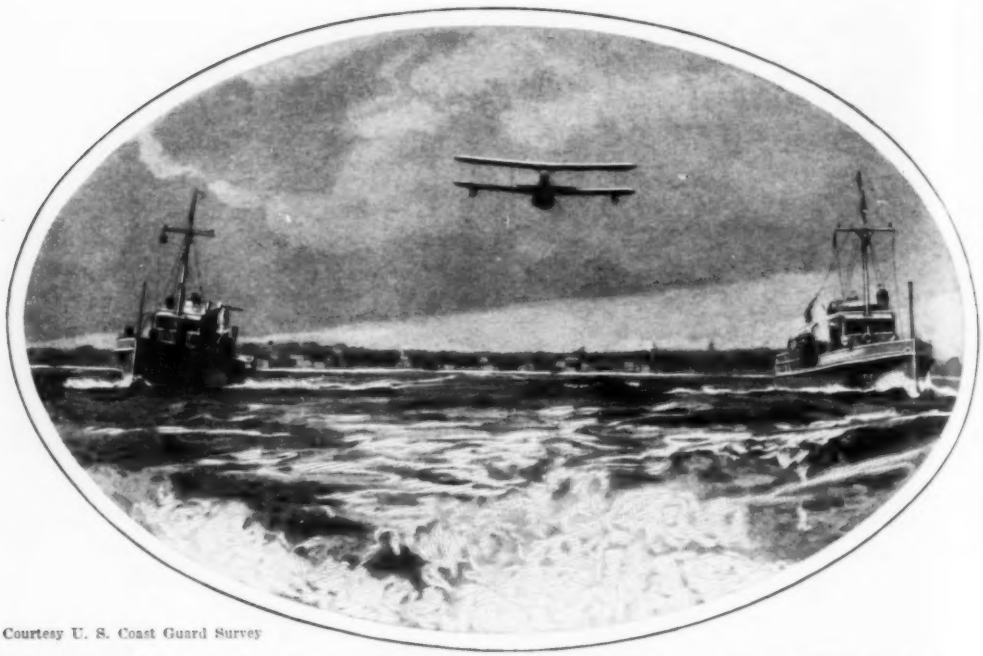
Jones' Cupboard

Courtesy Central Press

Rescue Plane Flying over Stranded Steamer with Life Line Being Lowered to the Crew; Aircraft, Summoned by Radio, Frequently Have Given Aid to Vessels in Distress

the skeletons in Davy Jones' locker, nothing is stranger than the mystery of the fate of the crew of the "Mary Celeste." Fifty-eight years ago, this stanch ship was found derelict in the North Atlantic, and today, in ports of the eastern seaboard of the United States, there are yet living descendants of the captain who are hoping that the mystery will be cleared up. They complain of sea writers weaving legends about the captain and crew of a ship which has become as weird in reputation as the mythical Flying Dutchman. Whereas, in fact, the truth about the "Mary Celeste" is stranger than any fiction.

What are the facts about this famous derelict? The "Mary Celeste," a brigantine of 282 tons, left New York for Genoa, Italy, on Nov. 7, 1872, freighted with alcohol. The captain, Benjamin S. Briggs, an American citizen, was part owner of the ship with James H. Winchester, a New York shipowner, and aboard on the last fateful voyage were the captain's wife and child. Besides the mate, Albert C. Richardson, the second mate, Andrew Gilling,



Courtesy U. S. Coast Guard Survey

Speeding by Air to the Help of Steamers in a Heavy Storm; an Airplane of the United States Coast Guard Survey Going Out to Sea

and the steward, Edward W. Head, were a crew of four seamen—Germans or Scandinavians—Walkert Lorenzen, Arian Hardene, Boy Lorenzen, and Gallhib Gondschatt.

For about seventeen days, the ship held on her course across the Atlantic till, at 8:00 a.m. on November 25, somebody wrote on the deck slate log that she sighted the island of Santa Maria, in the Azores. Twelve days after this last entry ever made on the ship's records, the British Nova Scotian brig "Dei Gratia," Captain Morehouse, bound from New York to Gibraltar for orders, sighted a strange ship, with jib and foremast staysail set, running on the starboard tack, but in so erratic a way that Morehouse decided to investigate. The ship was searched thoroughly, but not a soul was found. In the cabin a table was set for breakfast, but the meal had been only half eaten. In the foc's'le, the seamen's chests of clothes were quite dry, and the razors left behind showed no trace of rust. There wasn't a crack in the paint or planks of the deck, and if the "Mary Celeste" had met bad weather, why was it that a small phial of sewing-machine oil stood upright by a reel of cotton and thimble? Surely, rough seas would have upset that phial.

The captain of the "Dei Gratia" ordered the mate and two of the crew to take the "Mary Celeste" into Gibraltar, which they reached on December 13. "There were no boats aboard the 'Mary Celeste,'" said U. S. Consul Horatio J. Sprague, in reporting to Washington. "The vessel is said to leak some, but her new crew had no difficulty in bringing her into this port."

The cargo of alcohol was all in good order, except for one cask that had started; the exterior of the hull below the waterline showed not the least sign of damage; the ship herself was in excellent order. However, the sleuths noted one apparently sinister feature: Marks, seemingly of blood, stained the "Mary Celeste's" top-gallant rail, and both bows had been "intentionally slashed." The ship's bill of lading and manifest were missing. They examined and compared the logs of the "Mary Celeste" and the "Dei Gratia," and noted a strange circumstance.

Between November 25 and December 5 when the "Mary Celeste" was apparently abandoned, and actually sighted by the "Dei Gratia," the derelict ship seemed to

have held on her course with the wheel loose and no one at the helm. Now, the distance of the longitude of the place where the derelict was found by the "Dei Gratia" from that of the island of Santa Maria is about 527 miles, and, says the admiralty experts, "It appears almost impossible that the derelict should have compassed within that time such a distance at all events on the starboard tack, upon which she was met by the 'Dei Gratia,' when the log of the latter showed that the wind was blowing from the north all that time, and that she was on the port tack all the time."

This, in non-technical language, means that during the ten days the position of the sails of the "Mary Celeste" must have been altered by someone, "and the obvious inference is that the 'Mary Celeste' was not abandoned till some days after the last entry in her log."

© Topical Press

Lost Five-Master "Kobenhavn" at Her Moorings Before She Left Port; a "Phantom Ship" like Her Was Sighted off Tristan da Cunha

When the marshal of the vice-admiralty court entered the cabin of the "Mary Celeste," he found on the floor a curious sword. "I have examined it," reports Consul Sprague to Washington, "and it is evidently of Italian make, and bears a cross of Savoy on the hilt; it remains in the custody of the court. The chronometer and ship's papers cannot be found."

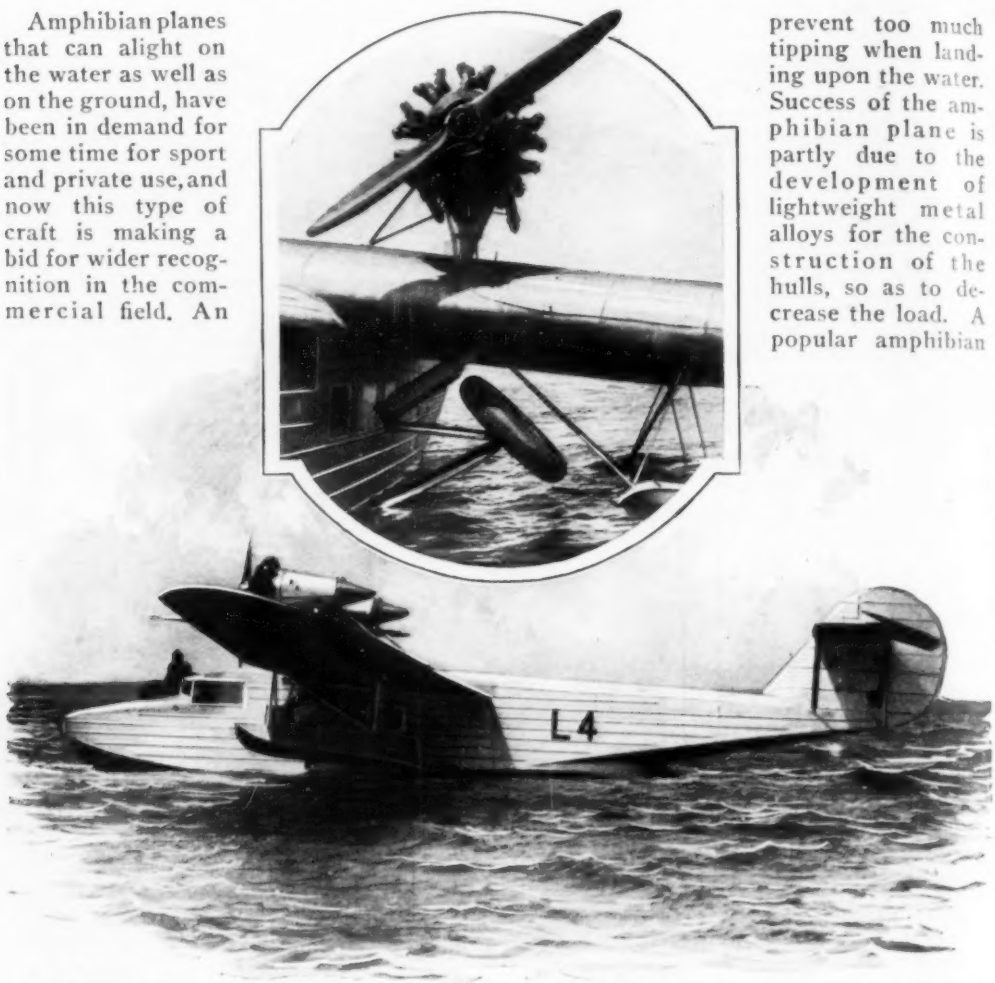
Capt. R. W. Shufeldt, of the U. S. warship "Plymouth," chanced at this time to call at Gibraltar, and went aboard the "Mary Celeste," at the request of the U. S. consul. "I reject the idea of a mutiny," said he; "there is no evidence of violence about the deck or in the cabins." And so this mystery remains unsolved.

West Australian airplanes, a liner from Capetown, a motorship, a steamer, and a fleet of Danish vessels have recently been unable to solve another mystery of the sea. A nearly new and well-found five-master sailing ship, the "Kobenhavn" left Montevideo, on Dec. 14, 1928, on a voyage to Melbourne, Australia, where she was to load wheat. Eight days out of port, in the South Atlantic, she signaled "all's well" to a passing Norwegian steamer, and then she vanished into the regions of the "Roaring Forties." Aboard were seventy Danish naval cadets and an experienced crew, and she was fitted with radio and auxiliary engines.

¶Those wishing further information on anything described in the editorial pages can obtain it by addressing Bureau of Information, Popular Mechanics Magazine.

GIANT AIR YACHT WILL CARRY EIGHT PASSENGERS

Amphibian planes that can alight on the water as well as on the ground, have been in demand for some time for sport and private use, and now this type of craft is making a bid for wider recognition in the commercial field. An amphibian that can carry eight passengers, besides a crew of pilot, navigator and wireless operator, has been built in England for a Canadian air line. It is said to be the largest in the world. Flying over a lake and river country, it can be brought to rest upon the water as well as on the land, for its fuselage is designed like a boat on the bottom and its landing wheels, as shown in the accompanying illustration, can be folded up to decrease wind resistance when the plane is in the air, and to be out of the way when descents are made upon the water. Pontoons under the wings help keep the craft afloat and prevent too much tipping when landing upon the water. Success of the amphibian plane is partly due to the development of lightweight metal alloys for the construction of the hulls, so as to decrease the load. A popular amphibian made in this country utilizes aluminum-alloy sheets, one-sixteenth of an inch thick, for the bottom of the hull and side sheets of the same material only one-thirty-second of an inch thick. Machine screws are used instead of rivets to assemble the members. As in boat construction, water-tight bulkheads are built into the hull fore and aft. A padded buffer is installed in the nose. Amphibians are being used widely for commuting and cross-country flying in regions where there are many lakes and rivers, and are finding a special place as carriers in large harbors. An example of this is San Fran-



Two Views of Eight-Passenger Air Yacht Recently Completed in England for Service in Canada; Note the Design of the Hull and How the Wheels Are Folded Up under the Wings

cisco, where amphibians fly between that city and Oakland in a fraction of the time required to make the trip by boat. Docking the amphibian is a simple matter, as it can climb out of the water on a ramp or floating dock and can be managed in much smaller space than a ferryboat.

BALANCING THE AIRSHIP IN FLIGHT IS BIG PROBLEM

Maintaining the balance of a dirigible without sacrificing too much of the hydrogen gas which provides the lifting power is the big problem on a long airship flight. It was this problem that the crew of the British dirigible "R-100" faced as the ship set a record of seventy-eight hours and fifty-one minutes crossing the Atlantic from east to west. The commander of a dirigible must calculate constantly to keep his craft from soaring upward or plunging downward as hydrogen gas is allowed to escape. Unless the temperature of the hydrogen in the gas bags is kept the same as the outer air, the lift will vary. Moreover, as the ship rises into less dense atmosphere, the hydrogen expands accordingly, and if the gas bags are full, the captain must sacrifice the reserve lift by letting hydrogen escape if he rises above what is known as the pressure height, which, for the "R-100," is about 2,000 feet, the altitude at which it travels most conveniently. False lift is another phenomenon that must be watched for. It is caused by action of the sun's rays which heat the interior of the ship, giving it a higher temperature than the outside air. This tends to send the ship up and force the blowing off of the gas. Likewise, at night, the ship which has been subjected to false lift tends to become heavier as the craft cools and the gas shrinks in volume. The "R-100" is not entirely at the mercy of such variations, because its surfaces are so curved as to provide a dynamic lift of their own when necessary, this being accomplished by the simple operation of pointing the bow upward.

Models of Atom Formations of Various Substances Such as Might Be Seen through a Powerful Microscope

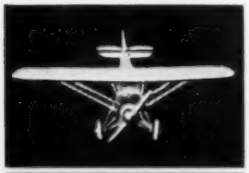
MODELS OF ATOM FORMATIONS SHOWN WITH BALLS

Models of atom formations as they group themselves into various elements or chemical substances can be illustrated with small balls placed on frames. Each ball represents an atom and the frame the formation as it might appear under a powerful microscope.

ARID FARMING IS A RETURN TO ANCIENT CUSTOMS

Present-day irrigation and dry farming constitute, in a way, a return to methods practiced centuries ago. Civilization originated in the semi-arid lands of the world, and only after the lapse of ages did agriculture leave such places and reach its greatest development in the temperate regions. Today attention is again paid to lands of little water, but with the improved methods derived from modern science, according to Sir John Russell, head of the oldest agricultural experiment station in England.

HOW YOU CAN TELL A PLANE BY ITS SILHOUETTE

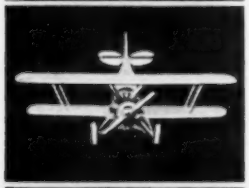


MONOPLANE

A monoplane is an airplane which derives its lifting power from one main supporting surface. It is distinguished from other planes by this feature.

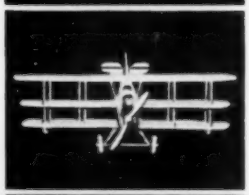
LOW-WING MONOPLANE

A low-wing monoplane is not unlike a high-wing type monoplane with the exception that its main supporting surface is placed below fuselage.



BIPLANE

You will have little difficulty in identifying a biplane by its two sets of wings, one set placed above the other.



TRIPLANE

A triplane boasts three sets of wings, one set placed above the other. The triplane, however, has lost favor with the modern designers.

SESQUIPLANE

A sesquiplane is a cross between a monoplane and a biplane. It is a wing and a half design with a main and a supplementary supporting surface.

PONTOON PLANE

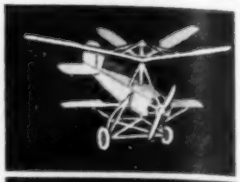
A pontoon seaplane is an airplane whose landing gear is fitted with pontoons. Frequently the pontoons are interchangeable with wheels or snow skis.

FLYING BOAT

A flying boat is a seaplane with a fuselage like a boat hull. The passengers sit in the hull as they do in a boat. For use over water only.

AMPHIBIAN

An amphibian is a new type of airplane, capable of landing on or taking off from either land or water. The landing wheels are retractable.

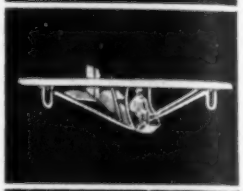


AUTOGIRO

An autogiro is a new type of plane which can ascend or descend almost vertically, in addition to horizontal flight. It is a newcomer to aviation.

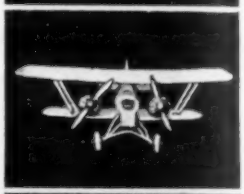
ORNITHOPTER

An ornithopter is a machine with flapping wings like a bird. Although countless attempts have been made, no ornithopter design has flown.



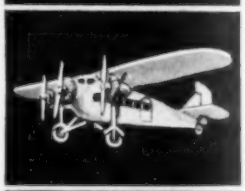
GLIDER

A glider is usually a monoplane without a form of motive power. A glider soars like a bird and depends upon upward currents for sustained flight.



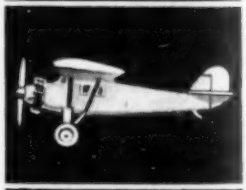
BI-MOTOR

Some airplanes are powered with two motors which are mounted on each side of the fuselage. These may be pushers or tractors. This is a tractor type.



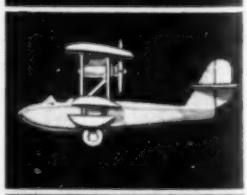
TRI-MOTOR

The majority of tri-motored airplanes are tractor types. The airplane illustrated is the new Stanolind 3rd—a modern three-motored monoplane.



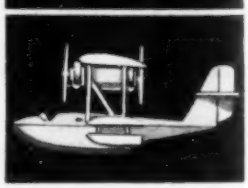
TRACTOR

To be termed a tractor, an airplane must be pulled through the air by its propeller. In a tractor type, the propeller is placed in front of the wings.



PUSHER

A pusher type airplane is pushed through the air by the propeller. In a pusher type, the propeller is always mounted in the rear of the wings.



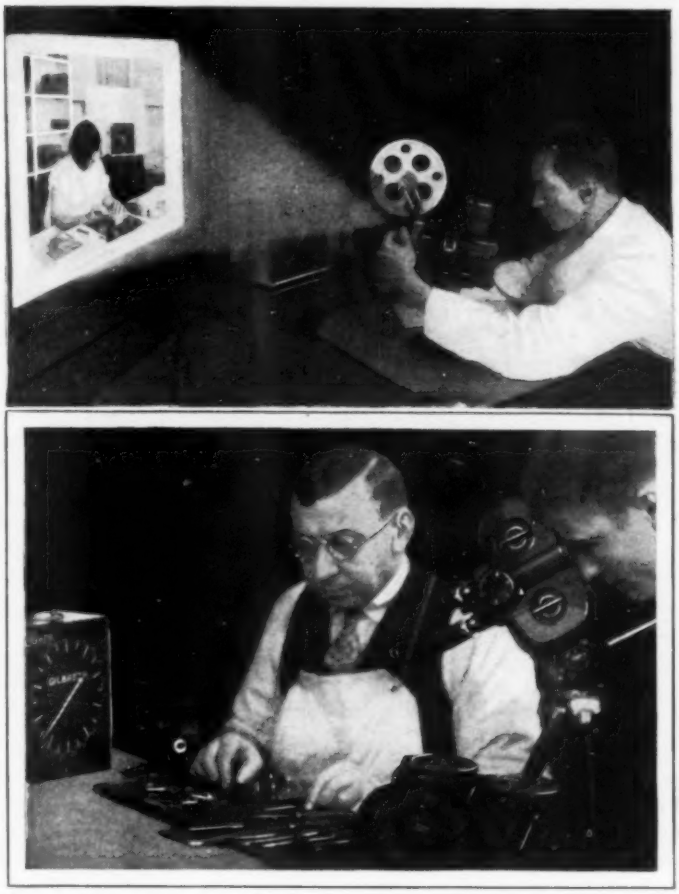
PUSHER-TRACTOR

In some multi-motored airplanes, the designers favor the pusher-tractor principle. One motor pushes and the other pulls.

Courtesy Standard Oil Company of Indiana

BUTTERFLY WINGS PHOTOGRAPH SELVES

Butterfly wings give off something—either invisible light waves or a gas—that enables them to photograph themselves in the dark, Austin Clark, of the National Museum, has discovered, and he is now trying to find what the emanation is. He mounted the wings on paper which was put in the bottom of a plate box to give a flat surface. A fresh plate, emulsion-side down, was placed on it, and the box, with light excluded, was laid away for a week. When taken out, the plate had a clear picture of the wings, complete as to detail and relative intensity of the color pattern, except that on the print black areas came out white and white patches as black. Specimens that had been dead as long as thirty years were subjected to the same tests and likewise took their own pictures, but not as clearly. It was found that, the agent, whatever it may be, does not pass through glass or quartz, but will go through cellophane.



Above, Studying Movie of an Industrial Process; Below, Taking Picture of Industrial Operation to Find Easier Way of Doing It

MOVIES TO SHOW EASIEST WAY OF DOING THINGS

To find the one best way of performing a task in industry without wasteful motions, the movie camera is being used to record the operation for study. The study of motions necessary in completing an operation is not a speeding-up process, but an effort to find the best, and usually the easiest, way of performing a task. Moving pictures of the performance to be studied are made, a fast-moving clock, known as a micro-chronometer, being included in the picture field and timing the various motions to one-thirtieth of a second. The picture then is analyzed by projection on a screen, one frame at a time, and by this slow and laborious process, the analyst draws up a simultaneous motion-cycle chart on which the motion of each part of the hands, wrists and arms is plotted against time. By this process all motions are broken down into seventeen fundamental ones, represented on the chart by colors and symbols. Study of the completed chart reveals violation of the laws of motion, and a new and better method of doing the job can be constructed synthetically. The operator then is taught this method, making possible increased production with the same, or less, effort. Lately an attempt has been made to eliminate the clock arrangement.

Four Men Pulling a Locomotive Weighing 711,500 Pounds; the Engine Is Equipped Throughout with Roller Bearings, Making Feat Possible

FOUR MEN PULL LOCOMOTIVE ON ROLLER BEARINGS

Four men recently pulled a locomotive weighing 711,500 pounds for a distance of 150 feet, starting the engine from a dead stop by hauling on a rope tied to the front. With an ordinary locomotive such a feat would have been impossible, but the test was performed with an engine equipped throughout with roller bearings. Friction had been reduced to a minimum by using such bearings for every part.

INSECT POLICE FORCE AT WAR WITH HARMFUL PESTS

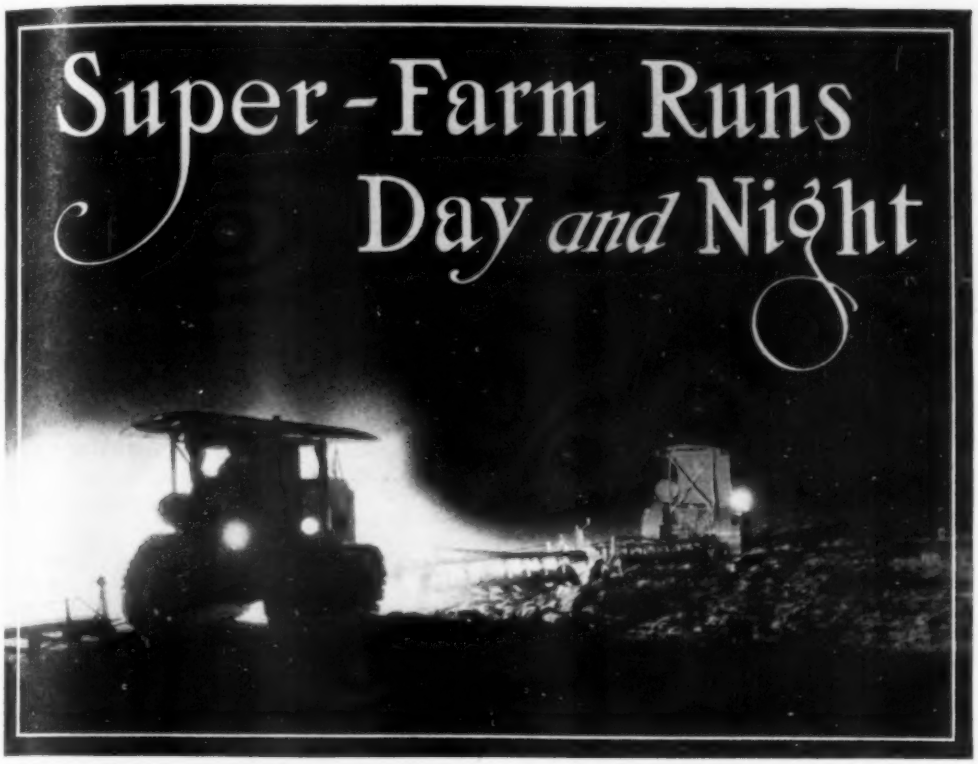
In its fight against insect pests, which annually destroy about ten per cent of the world's crops, science has enlisted an insect police force as one of its most potent weapons. It has been found that there is hardly an insect that is not preyed on by some other, and science has turned this fact to its own advantage in dealing with the harmful bugs and flies. The greenfly, for instance, which damages roses, has a powerful foe in the larva of the ladybird, and ichneumon flies keep the devastations of caterpillars within bounds. Whenever a plague of obnoxious insects is reported, flying squads are imported to battle them. These are insects which are known to prey on the pests and are bred in large numbers in Europe in order always to be in readiness for such an emergency. Such policemen insects have been sent to Australia, New Zealand, Canada, India, Africa and the West Indies, and each year are traveling farther and farther in relentless battle on their natural enemies.

AUTOMATIC GOLF TEE OPERATED BY PEDAL

Enabling the golfer to practice shots without stooping to tee the ball, an automatic teeing device is operated with a pedal. Pressure on the pedal releases a hinged arm with a spoonlike cup which snaps over and places the ball on the tee. The arm then returns to a horizontal position with the cup under a rack which holds thirty balls. The golfer thus can make one shot after another without changing his stance.

Automatic Tee for the Golf Ball; Pressure on the Pedal Places a Ball Ready for a Shot

Super-Farm Runs Day *and* Night



With the Aid of Powerful Headlights on the Tractors, Plowing Proceeds at Night as Well as by Day, and the Workers Enjoy the Benefits of Comparative Coolness

IN THE VICINITY of Amarillo, Tex., a stupendous enterprise is in progress. An outfit of ten sixty-horsepower tractors, going day and night, are converting thousands of acres of prairie into plowed ground. This outfit belongs to Hickman Price, whose farming operations are as startling in magnitude as they are unusual in method.

There was a time when the popular conception of a farmer was a weathered toiler of the sun, struggling for existence under trying conditions, the pawn of politics, climatic conditions and his own poor judgment. But the shifting scenes have brought another picture: agricultural engineers trained in the best universities are directing their efforts toward farming. In Hickman Price, farmer, we find a Columbia graduate, a business executive of high standing and a cultured man of the world.

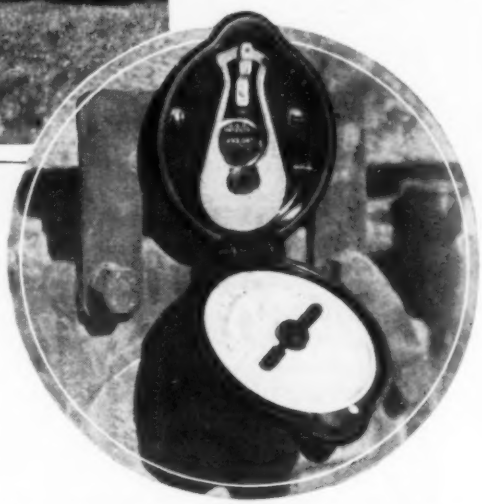
Even in the Texas Panhandle, 30,000 acres, or fifty sections of land, have always been regarded as a tract too large to utilize in any way except for cattle raising. Had anyone, even so late as two years ago, suggested to the owner of such a tract that it be put under cultivation, the idea would have registered as the wildest on record. Yet, that is the extent of land that Mr. Price has in cultivation, to say nothing of an additional 25,000 acres of virgin prairie he has plowed the last few months.

It was in 1902 that Mr. Price made his initial venture in farming. This was also the year that he first visited the land he is now cultivating, the land his grandfather purchased somewhere back in the seventies and then forgot about. He amused the seasoned cowmen when, after graduation from college, he started plowing with a steam tractor out there on the wild plains of a cattle empire.

"One objection to superfarming," said Mr. Price, "has been that as the capital for it increases, so do the hazards. The answer to this has been found by such concerns as the United Fruit company. It distributes its vast acreage over large areas, in

handle to use sixty-horsepower tractors—"and by operating on a factory basis of continuous operation, the cost of growing wheat can be slashed far below the cost to the small farmer. Thus we can make a fair profit from prices that would embarrass him.

"In Montana it is estimated that on 800 to 1,400-acre farms with thirty-horsepower tractors, the cost per acre can be reduced to $8.70. Our tests, here in the Panhandle, where twen-



Close View of One of the Huge Tractors and Clock Used to Record "Bonus" Time

ten or more tropical countries. The effects of vagaries of the weather are correspondingly distributed."

Hickman Price's operations embrace four tracts in four counties of northwest Texas. It is seven miles between the two closest farms and 120 miles between the two that are farthest apart.

"With the seasons varying from year to year," he declares, "the surest air-tight defense against unfavorable weather conditions—the proverbial bugaboo of farming—is found in an ample supply of power and equipment. Having machinery sufficient to cover the entire acreage in a short time, it is possible to avail oneself to the utmost of all the important element of timeliness, making or saving crops otherwise lost. Thus, in large measure, mechanized agriculture effectively combats that which, up to now, has been the bane of farming."

"How about the fluctuation in the price of grain?" I asked. "How do you take care of that side of the problem?"

"Our recent studies of wheat costs," Mr. Price returned, "show that merely by using standard tractor power double that of the largest commonly used tractor"—Mr. Price is the first farmer in the Pan-

ty-four-hour tractor operation is practical, indicate that with the biggest tractors and correspondingly larger implements, the cost can be reduced to $6. We believe that even larger types of machinery and more extensive unit areas will result in greater reductions in production costs. We hope that the time is near when manufacturers, aided by agricultural engineers, will make it possible to farm at constantly lowering prices through the use of superpower machinery with tractors of, say, 500, 800 or 1,000 horsepower.

"Our tractors run continuously day and night," he continued, "stopping only for

Some of the Tractors That Turn 200,000,000 Tons of Soil Per Year, and Big Derrick Used for Repairs

servicing or when the ground is frozen or too wet. There is always work ahead for a successful, expanding farm organization as it takes over new acreage to put into wheat. This means that our tractors operate from 5,000 to 6,000 hours a year. In intermediate gear, at about three miles an hour on most of the jobs, each tractor travels approximately 18,000 miles.

"The new assumption is that scientific farming has one goal, that of producing foodstuffs and other commercial products as cheaply as possible and without injury to farm workers.

"The old method of getting low production prices was through exploited or underpaid labor. The producer has been made to suffer for the sake of the consumer. That was unjust. The new ideal is to be equally fair to all concerned."

This is not a mere theory with Mr. Price, and it is fully demonstrated in the way his men are managed. Each worker is made to feel that he is a definite part in the scheme of superfarming. He has set a new standard of wages for farm hands which is the most generous ever paid in this country; he has set a new standard of home life for farm hands, enabling them to enjoy every necessary comfort and convenience.

His tractor drivers receive a base wage of $90 per month and a ten-cent bonus for every hour they run their machines. Workers in other departments—he employs twenty-five to about a hundred men—receive correspondingly generous salaries. For it must be remembered that agricultural labor is about the poorest paid in any industry.

Mr. Price's employes live on a train which is moved overland from one large farm to another. It consists of sleeping, dining and club cars with complete repair and shop equipment. The club car is equipped with shower bath, hot and cold water, a lounging room with comfortable chairs, desks, radio and magazines.

All this "fuss" over hired help has caused much comment among farmers in northwest Texas, but Mr. Price contends that better living standards for farm workers must find adjustment to this new era of superfarming.

GARDEN DRAWING ROOM ARRANGED FROM HEDGE

A Summer Drawing Room in a Garden; an English Gardener Designed This Arrangement of Carefully Nurtured and Clipped Hedge, Plants and Flowers; Note Chairs and Fireplace

As a model for those who entertain extensively in the summer, a British gardener has arranged a garden drawing room. It is made from carefully nurtured and clipped hedge, plants and flowers, and besides its green walls, the appointments include a fireplace, chairs and a phonograph.

MINIATURE DRY-STEAM PLANT IN AN ELECTRIC IRON

Weighing only three pounds, a small dry-steam outfit is contained in an appliance resembling and operating like an electric flatiron. It plugs into any light socket, the heating element converting water into dry steam which is evenly distributed over the pressing surface. Similar outfits may be obtained with a larger boiler for continuous operation, or with an attachment for a steam line.

RADIO FROM PLANE GOES HALF AROUND THE WORLD

From an airplane 5,000 feet over Buenos Aires, Capt. Lewis Yancey recently talked by radiophone with Sydney, Australia, thus telephoning from an airplane in flight over a distance of 14,000 miles. His conversation went by radio to a radiotelephone station in Buenos Aires, then by radio to Madrid. At Madrid the conversation was transferred to land lines of a telephone company which took it to the French border, where it was transferred again to other land lines and carried to the English channel. A submarine cable took it to England, then other land lines carried the words to a radiotelephone station at Rugby. From Rugby the beam wireless carried the words to Sydney. The conversation was quite distinct.

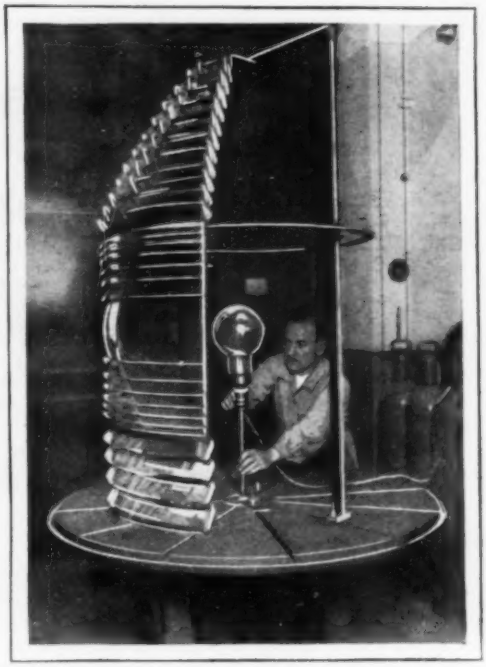
ARTIFICIAL SUNSHINE SPEEDS UP NIGHT WORKERS

Imitation sunlight, shining through fake windows to approximate further the effect of real daylight, has been found to speed up the production of night workers. Experiments in London by the national physical laboratory showed that the eyes are more at home under conditions as nearly as possible like natural daylight, and that better vision resulted in better work. A comparison of the hourly output of night clerks in offices working under ordinary artificial lights and under artificial sunshine showed a distinct balance in favor of the latter. Coloring of the light to approximate the sun's rays was found to be the most essential condition.

BOY'S INVENTION SAVES HOME WHEN FIRE THREATENS

In his homemade laboratory, a sixteen-year-old Philadelphia school boy made a fire extinguisher out of odds and ends about the house, and loaded it with proper chemicals, awaiting only a good chance to test it. The opportunity came when fire broke out in the home of the family. The homemade apparatus put out the blaze before serious damage was done.

Philadelphia School Boy and His Homemade Fire Extinguisher Which Saved the Family Residence



Four-Foot Searchlight Lens for a Lighthouse, and the 3,000-Watt Bulb Used with It

GIANT LENS FOR SEARCHLIGHT TO GO IN LIGHTHOUSE

Lighthouses and searchlights are constantly studied and improved by the state institution for sea marks and navigation, near Berlin, where much research work is done in experimenting with equipment which will prove more efficient in warning ships of danger. One of the recent pieces of equipment that underwent tests was a giant searchlight lens four feet in diameter. The light source to be used with it is a 3,000-watt bulb.

CHEMICAL ACTS AS DETECTIVE OF DEADLY GASES

Warning of the presence in the air of carbon monoxide and other deadly gases may now be given by a chemical in a handy little container which can be carried by workmen going into suspected garages, sewers or mines. When the outer covering of the packet is crushed, a white filter paper or piece of cotton, soaked in palladium chloride, is exposed to the air. When this chemical meets carbon monoxide, the palladium is freed and the cotton turns gray or black.

Submarine Carrier Which Was Used to Transport the Undersea Craft from the Ocean across France to the Mediterranean Sea

CARRIER FOR SUBMARINE TAKES BOAT THROUGH FRANCE

When the French submarine "Argonaut" recently was ordered to proceed from the coast to its base in the Mediterranean, its officers faced the task of taking the craft across the heart of France. The problem was solved by building a submarine carrier in the form of a large scow in which the sub was placed.

INSECT FAIR FOR COLLECTORS FROM ALL OVER WORLD

One of the strangest fairs in the world is held annually at Frankfurt, Germany, in the form of an insect exhibition. Here collectors from everywhere gather to meet the sellers of rare butterflies, moths, beetles, flies, grasshoppers and crickets. Some rare specimens bring large sums of money. Most of the vendors bring their stock with them, but others come empty-handed and merely take orders for rare insects as yet unborn, because they know where these tiny creatures may be found. While the insect fair probably is the strangest of all, another city has a goose fair and still other towns have mop and fur fairs.

TINY CYCLE MOTOR RUNS MANY MILES TO THE GALLON

One hundred and fifty miles to a gallon of gasoline is the average performance of a lightweight motorcycle, the power plant of which, with magneto, weighs but twenty-five pounds and may be used for sawing, grinding, pumping, generating current, and many other purposes where a portable unit is needed. Attaching the motor to an ordinary bicycle frame is not successful, as a special frame, built to withstand the strain of operation and shaped to fit the motor, is necessary. The motorcycle has been run as far as 225 miles on a single gallon of fuel. The motor develops one and one-half horsepower, is a valveless, two-stroke affair of the simplest design, and drives the cycle through a chain-and-belt transmission. A special feature of the cycle is that its lights are supplied with current in ordinary bulbs directly from the magneto. The complete cycle weighs eighty-four pounds and runs at from three to thirty miles an hour.

Midget Motor for Motorcycle Which Makes About 150 Miles to One Gallon of Gas

PLANE RESEMBLING VULTURE TO SOAR LIKE A BIRD

Comparison of Model of Plane Shaped Like a Bird and the Vulture It Resembles; the Makers Expect to Apply the Principles of Aerodynamics Used by Birds to Enable the Ship to Soar

Construction has been started in Los Angeles on an all-metal airplane wing that is expected to embody the intricate aerodynamical system that nature bestowed on the eagle, vulture and albatross—a system that requires no flapping of wings or artificial power plant to sustain flight. The wing is not an invention, but merely the application of the heretofore unknown principle of the bird's flight. Experts long have studied the natural phenomenon that allowed the vulture or eagle to soar without apparent effort, and now are attempting to apply this principle to man's advantage. It is claimed the vulture-type plane will be superior to present aircraft by tripling the lifting power, cutting the motor horsepower in half, increasing the pay load 150 per cent, reducing the landing speed by sixty per cent, shortening the take-off ninety per cent and decreasing both fuel consumption and dead weight.

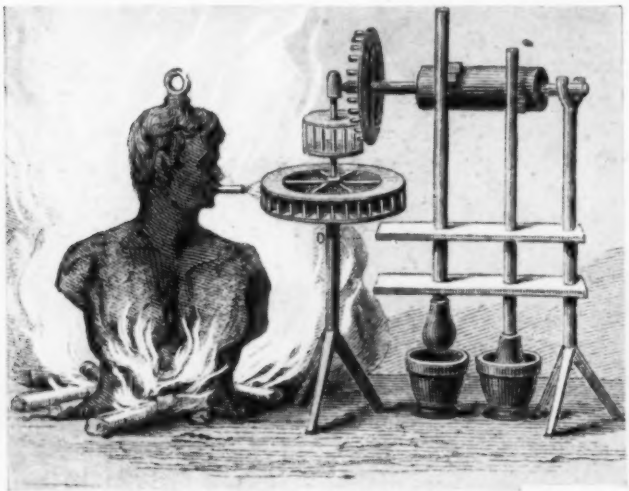
GYMNASIUM ON RAILROAD CAR

One Canadian railroad has added to one of its principal trains a combination lounge car containing a small gymnasium, as well as a soda fountain, baths, barber shop and radio-reception room. The exercise room contains various kinds of massage apparatus as well as foot and hand-exercising devices. Next to it is a shower. The windows are of glass which permits the passage of the ultraviolet rays of light.

GUIDE BLOCK FOR ANCHOR ROPE HAS AUTOMATIC GRIP

Operated from the seat of the boat, and without any springs to get out of repair, an anchor-rope guide block has a grip that takes hold automatically when the line is released. It consists essentially of a pulley with a spiral groove which throws the rope between the pulley and the guide when the line is allowed to run free, thus jamming it, and holding the anchor at any height desired. It operates as simply as a window-shade roller, gripping the line instantly as soon as the rope is released after the anchor is raised.

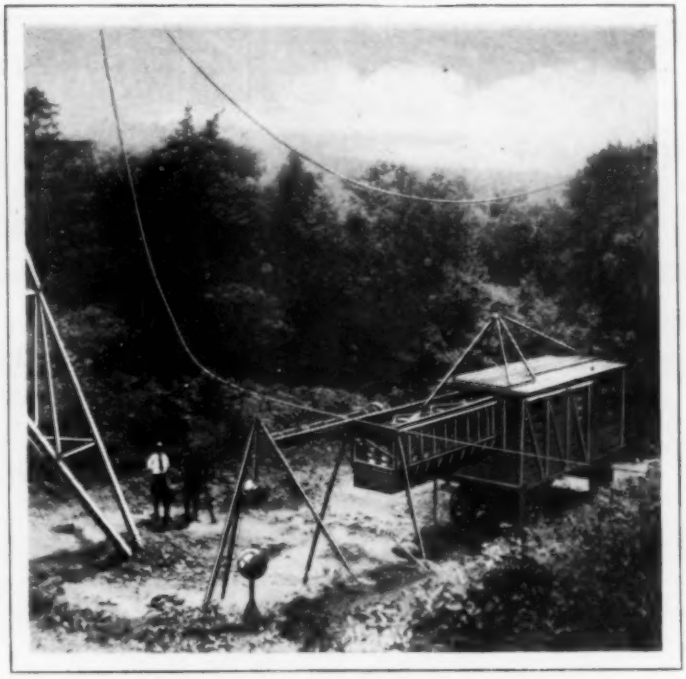
HOW MAN CAME TO KNOW THE WONDERS OF STEAM



Above, Forerunner of the Modern Steam Turbine; Right, Model of First Steam Engine; Below, a Steam Engine Invented in 1712

The National Museum in Washington has placed on view an exhibit to show "How Man Came to Know Steam." It begins with a steam toy, invented by an engineer named Hero, of Alexandria, in Egypt, about 150 B. C. Not until the middle of the sixteenth century was anything more heard of the uses of steam. But in 1629, an Italian chemist, Giovanni Branca, invented a steam engine to generate power, and his design, later modified, developed into the modern steam turbine. In 1690, a French engineer named Papin invented the safety valve, and suggested the use of steam to drain water from mines, etc. The rudiments of a power-generating steam engine having been contributed by Branca, Papin, and others, it only awaited the touch of a mechanical magician to become a complete achievement. That touch was given in 1698 by Thomas Savery, an English coal-mine operator, who built an engine, with cylinder and piston, for lifting water out of his mines. Fourteen years later, an English blacksmith, Thomas Newcomen, constructed a steam engine which was one of the most remarkable inventions of any age or time. From it grew the modern steam engine. An engine of the Newcomen type (imported from England, and the first steam engine ever seen in America) was set up near Newark, N. J., in 1754, to drain a copper mine. The first person in the United States to apply steam for propelling a boat was William Henry, gunsmith and famous patriot, who, in 1763, built a small stern-wheel craft and launched it on Conestoga creek, at Lancaster, Pa. It carried no passengers, but was designed to prove that a steam-driven boat could travel upstream, against the current. Twenty-four years later, with the first passenger-carrying steamboat, John Fitch made a successful trial trip on the Delaware river. Fitch died in 1798. Nine

years later the reward which he had sought came to Robert Fulton, whose steamboat, the "Clermont," made its first trial trip up the Hudson, Aug. 7, 1807. In 1805, Oliver Evans built in Philadelphia the first steam-driven wagon seen in the United States. It was a dredge, designed for work along the river docks, but could run on land under its own power. Evans made definite prediction of carriages running on railways. "The time will come," he said, "when people will travel in stages moved by steam engines almost as fast as birds can fly, fifteen to twenty miles an hour." Indeed, by that time railways of some kind were plainly seen to be a necessity for commerce. The question was, what motive power could be used? A treadmill car operated by horses, carrying twenty-four passengers, won a $500 prize. Cars equipped with masts and sails were tried. Evans' prediction was ridiculed. But when, in 1829, news came from England of the wonderful performances of George Stephenson's locomotive "Rocket," all doubt about the use of steam for power was removed.



Portable Lightning Generator Capable of Developing 1,000,000 Volts, Used to Determine Effects of Lightning on Power Lines

RADIO TUBE WITH METAL COAT HAS GRID ON OUTSIDE

In Germany a type of radio tube in the form of a flat container, somewhat resembling a tube of tooth paste, is being produced. The grid is not inside the tube, but is in the form of a metal layer on the outside of the glass. It is made at lower cost than the ordinary tubes and operates as efficiently.

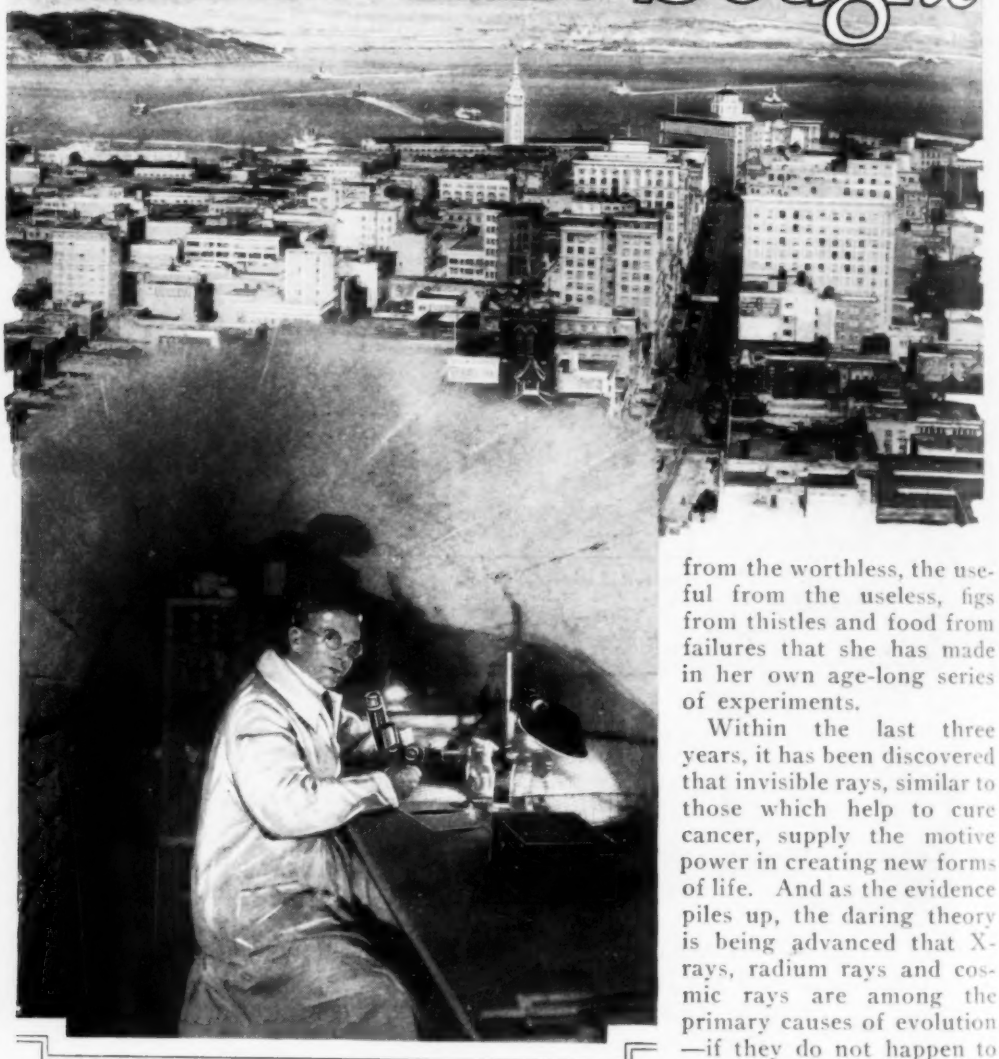
PORTABLE LIGHTNING FACTORY TESTS POWER LINES

To determine the effects of lightning on overhead transmission lines and power-station equipment, a portable lightning factory, capable of generating 1,000,000 volts, has been made in compact form so that experiments can be conducted from different locations. The generator is being used extensively in the mountains of Tennessee, where the man-made bolts are released near the electric-power lines in an effort to approximate the effect of Nature's much more powerful bolts.

ATTACKS BY CHINESE PIRATES CALL FOR EXTRA GUARD

Shipping companies have formed special guards to protect their passengers and property from attacks by Chinese pirates, according to reports from England. During the past year, two British ships were attacked. The third officer of one of the vessels was killed. Temporary arrangements were made for military guards, and a police organization is now functioning.

Secret of Life Sought



Prof. E. B. Babcock, of the University of California, in His Laboratory Deep beneath the City of San Francisco

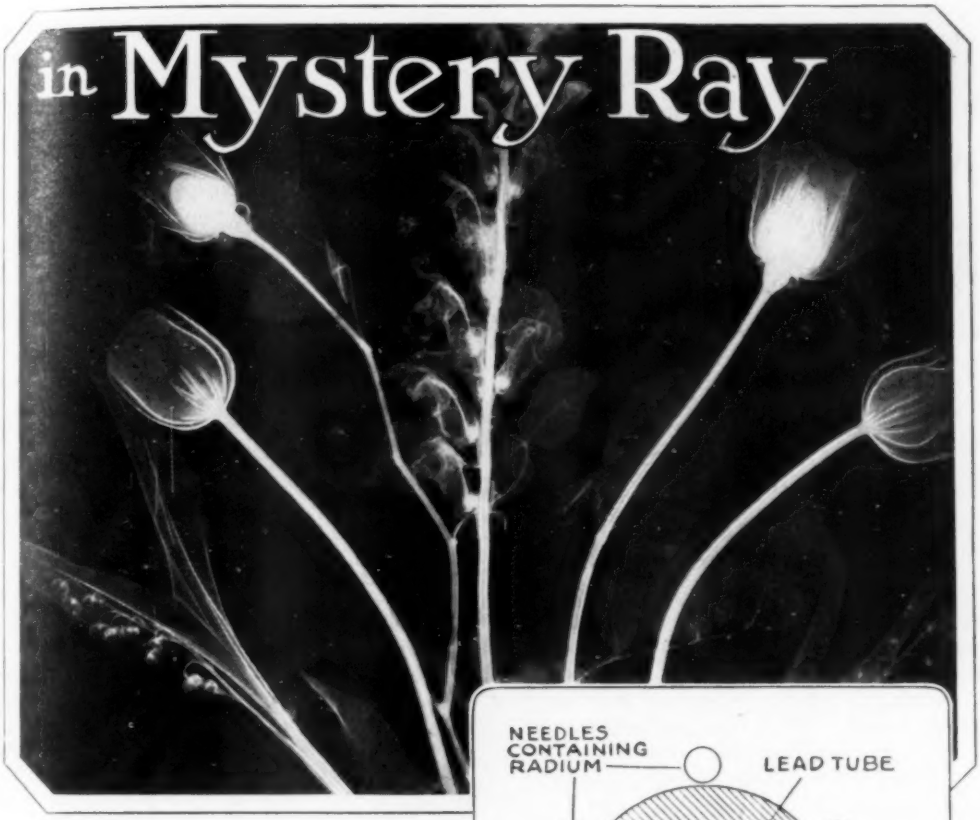
WHY the difference between the mouse and the mastodon? What makes one tree produce apples and another oranges? What entered into plant life to develop poppies on one and sweet peas on another?

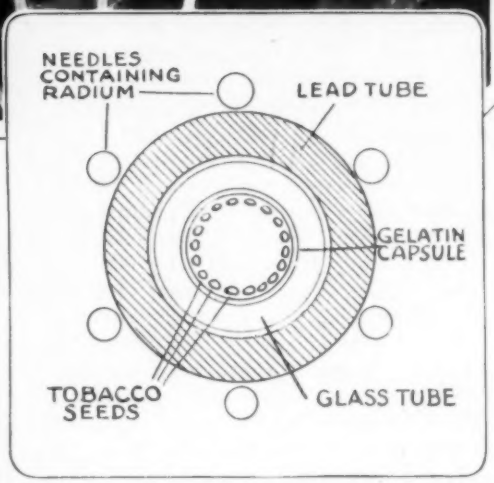
Following this line of questioning, scientists now are seeking to unearth Nature's secrets so they can produce the worthy from the worthless, the useful from the useless, figs from thistles and food from failures that she has made in her own age-long series of experiments.

Within the last three years, it has been discovered that invisible rays, similar to those which help to cure cancer, supply the motive power in creating new forms of life. And as the evidence piles up, the daring theory is being advanced that X-rays, radium rays and cosmic rays are among the primary causes of evolution—if they do not happen to be the sole cause.

Three years or so ago, Prof. H. J. Muller, of the University of Texas, startled the world by his discovery that fruit flies, given a dose of X-rays, produce offspring radically different from themselves. "They were a motley throng," reported this scientist. "There were big flies and little ones; dark ones and light ones; fertile and sterile ones; long-lived and short-lived ones. What had been done? The root of

in Mystery Ray





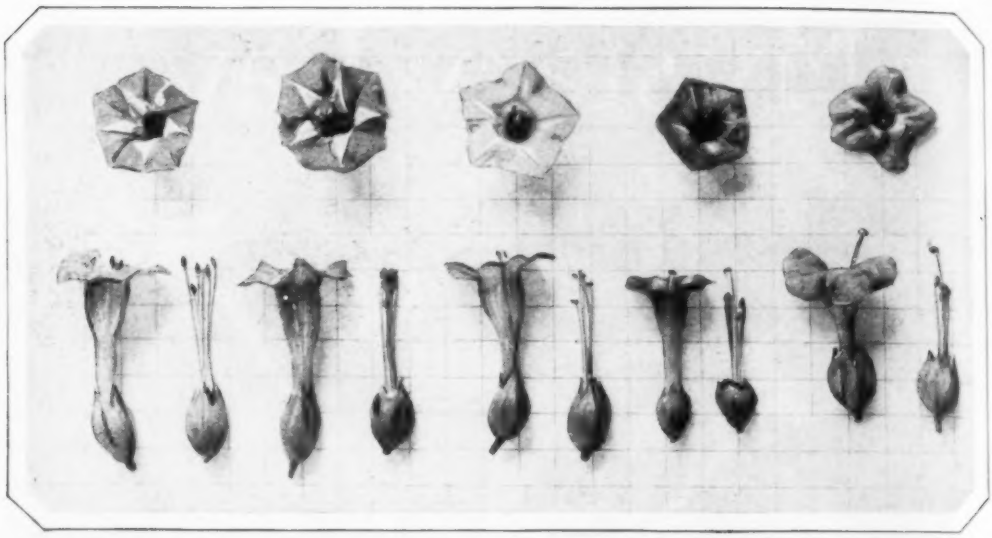
How Flowers Look under X-Rays, and Diagram Showing How Rays Are Applied to Tobacco Seeds

life had indeed been struck and yielded."

About a year later, Prof. T. H. Goodspeed, of the University of California, created new types of tobacco plants with the aid of X-rays. Flowers, leaves and stems produced by the treated seeds differed radically from those grown from untreated seeds. Contrary to expectation, it was found that the X-rays possessed no power to kill the seeds of the plant, but that early growth was slightly retarded. Further experiments with radium rays produced similar results.

Prof. E. B. Babcock, of the same institution, has supplied further evidence. In a tunnel through 150 feet of solid rock beneath a portion of the city of San Francisco, a laboratory had been fully equipped, it having been shown that the natural radioactivity of the rocks in the tunnel was exceptionally high. Exposed to this unusual intensity of radium rays, the offspring of fruit flies have displayed marked evolutionary changes, new kinds of flies being produced in much the same manner as in the laboratory of the University of Texas.

In these experiments, the effect of cosmic rays from the realms of space have been taken into consideration. Where they come from no one knows. Prof. Robert A. Millikan, of the California Institute of Technology, has proved their existence and suggests that possibly the



How Generations of Plants Change through Effects of X-Ray Treatment; Top and Side Views, Below, with Tubes Removed; Note Marked Changes from Extreme Left to Right

distant stars may send forth this energy which is continually reaching our earth both day and night. Possibly cosmic rays have played a most important part in the production of the strange prehistoric creatures that once roamed the world.

"Below the wavelengths of visible light," says Doctor Goodspeed, "are the radiations of increasingly high frequency, that is, shorter waves—the ultraviolet, the X-rays, the gamma radiations of radium and, finally, the cosmic rays. Waves visible to us as light vary from .00028 to .00014 of an inch, while the cosmic rays, for example, show distances from one wave to another, of approximately four-trillionths of an inch. Possibly these lengths will be better understood when it is said that, if visible light waves could be so magnified that they were fifty to 100 miles long, the cosmic ray would have a maximum length of one-half inch."

The cosmic rays, charging down from interstellar space with power to pierce twelve feet of lead or more than 100 feet of solid rock, were shut out of the tunnel used by Doctor Babcock as a fly laboratory. A similar control and experiment station was established at the University of California, in Berkeley, from which the cosmic rays were not excluded. It was found, also, that earth radiation in the tunnel is more than twice as strong as it is in the laboratory at Berkeley. Then the fruit flies were subjected in the one place to the earth-made rays to which all life apparently has been subjected since time began, and in the other to man-made rays of exactly the same kind. This was an excellent test of the actual effect of the natural radiation of the earth on life changes.

All living substances are now known to be radioactive and, in regions of rapid growth, the emanation is strong enough to affect a photographic plate. When actively growing tissue is artificially treated with X-rays, or radium, very remarkable changes in the processes of growth take place. This is the secret of the fight against cancer by the use of X-rays as well as the changes produced upon metals, in industry, in plants, in animals. This field of research is very new, but in the words of Dr. C. Judson Herrick, of the University of Chicago, it gives promise of opening up secrets of vital mechanisms which ten years ago no one could have dreamed of.

Professor Muller produced life changes 150 times as fast by the use of these invisible rays as is possible by the ordinary processes of nature. This means that man may be able to force the production of new and desirable plant and animal varieties far more rapidly than he has hitherto been able to do.

Professor Goodspeed points out that, under right conditions, a fruit tree could

be given a dosage of the rays and certain branches would bear a different kind of product, the cuttings, being planted, would go on producing that new variety, possibly totally different from any ever known.

New laws of nature are being discovered. It is not impossible that what we have believed to be natural laws are really not "natural," but rather the results of "accidents" such as great sweeping of cosmic rays upon the earth. Something of this sort is suggested in the work of a Russian scientist of note, Doctor Vassilief, who is working to make animal life and human life transparent. He has been able to make the cells of inanimate bodies transparent or invisible and believes that, by the use of radium rays, he may ultimately succeed upon living cells.

"If the bones and organs themselves become so nearly invisible, they can be slightly colored, and at one glance by a physician it will be possible to see if a person has a cancer or merely a stomach ache."

Dr. T. A. Wilson with X-Ray Apparatus, and, Below at Left, X-Ray-Treated Plant Compared with Natural One of Same Kind

Animal life would be made to appear like the photograph taken of a pistol or automatic, showing instantly all its parts. Other effects of the rays may change the very organs in unknown ways.

Man, put together by bits of tissue and cells operating as the parts of a machine, may be changed to operate in an entirely different way by the application of X-rays. As shifting of wheels, nuts, screws and bolts changes a machine, so the X-ray changes the life form and there is a new creation.

AN OUNCE OF RADIUM IN EIGHT YEARS

In Czechoslovakia is a chemical plant where 300 workmen have labored for eight years to produce one ounce of radium, which it is making at the rate of about three and one-half grams a year, equivalent to one-eighth ounce, and valued at about $2,500,000.

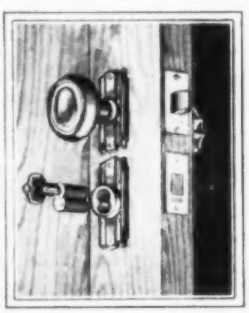
LIFE-SAVING KNAPSACK HOLDS USER'S VALUABLES

Life-Saving Knapsacks Which Not Only Keep the Wearers Afloat, but Also Provide a Dry Place for Clothing and Other Valuables; the Buoyant Apparatus Is Worn About the Neck

Not only enabling the victim of a boat accident to remain afloat, but also allowing him to keep his valuables dry, a life-saving knapsack was recently tested successfully in Berlin. Clothing and other valuables are placed in the knapsack, which is specially treated and water-tight. The sack is worn about the neck and is so buoyant that it sustains the weight of the wearer and the contents of the bag.

REMOVABLE CORES FOR LOCKS OPERATED BY MASTER KEY

Door locks and padlocks with removable cores have the advantage over ordinary locks of adjustable combinations in the cores, thus enabling the owner to set all his locks on the same combination and operate locks for house, garage and even his automobile with one master key. To all outward appearances the locks resemble the usual kind, the cores containing the lock mechanism being removed with a special key.



All cores are interchangeable, and if desirable, some locks can be set at one combination and others at another, thus enabling one set to be operated with one key, and the second with another. This, for instance, enables one key to open all the locks in one section or suite of offices without operating those in other parts.

PESTS KILLED BY ELECTRICITY

Garden pests, such as caterpillars and green flies, are being successfully electrocuted instead of poisoned by one English gardener. He has made a "death wand," an arrow-shaped copper plate connected with a simple arrangement of batteries, insulated leads and switches, the entire apparatus somewhat resembling a small radio set. There is a voltage-control switch to supply current in varying strength to different classes of plants, and, in use, the wand is flicked over leaves and stems of the infested plants, killing insects on or inside the plants without injuring the vegetation.

REAR-VIEW MIRRORS AID PILOT SIGHT TAIL-FIRING GUN

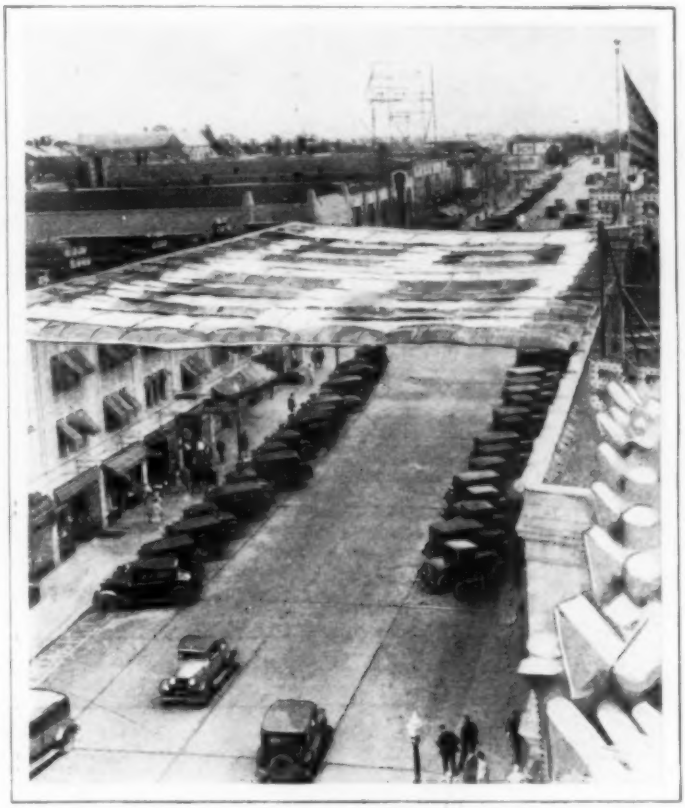
Rear-view mirrors have been installed in one single-seater British fighting plane to enable the pilot to fire "blind" but accurately at a target behind his ship. Reflex mirror sights have been connected with a gun trained to the rear of the plane, thus enabling the pilot to obtain an accurate aim on his target by looking into

a mirror on his instrument board. By this means he will be able to dive down at a target, sending out a hail of lead from guns trained forward, then, zooming upward, he can bring the tail gun into play. The mirrors are so arranged that, when the target is reflected in the instrument-board glass, the gun is trained on it. The sighting mirrors are electrically heated and wiped so as to give clear vision despite varying atmospheric conditions.

MOTOR VIBRATION IS DETECTED BY USE OF EGG

As a vibration detector, an ordinary hen's egg is quite commonly used to test an airplane motor. A spoon is clamped to the motor and the egg placed in it. With a cylinder disconnected, the engine is revolved at high speed, and any vibration in the engine is at once transmitted to the spoon and the egg. Lack of vibration allows the egg to remain perfectly still in the spoon.

Testing the Vibration of an Airplane Motor with an Egg in a Spoon Clamped to the Engine



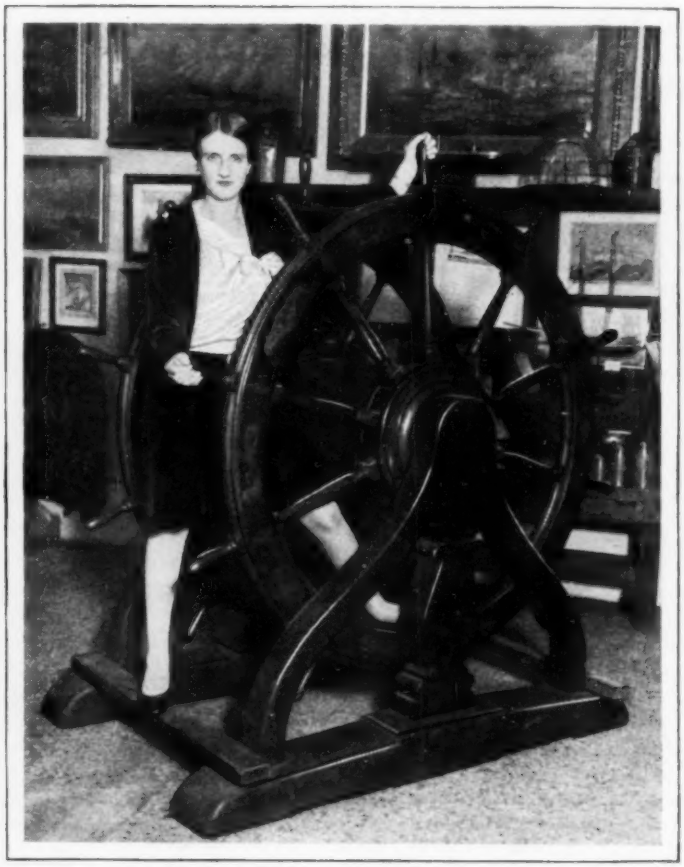
Awning Containing 6,000 Square Yards of Canvas Stretched over a Business Street to Protect Shoppers from Sun and Rain

AWNING FOR BUSINESS STREET PROTECTS SHOPPERS

To protect shoppers from rain and sun, merchants of Darby, Pa., purchased a vari-colored awning which was placed above the principal business street. It entirely covered the street from building line to building line.

GASOLINE CARRIED IN PIPELINES

Gasoline shortly will be transported by underground pipelines from refineries to marketing centers. One oil company is planning a 550-mile line costing $5,000,000 and capable of moving 15,000 barrels daily from its plant in Pennsylvania to Lake Erie shore cities, and eventually into New York state. Another company is rehabilitating an old Pennsylvania oil pipeline to move fuel westward from its New Jersey refineries, and a third plans a gasoline pipeline from the mid-continent area to St. Louis and Chicago.



Steering Wheel of the "Powhatan," in Which Commodore Perry Visited Japan, the Trip Resulting in the Treaty Opening the Island's Ports

PEACE SHIP'S STEERING WHEEL IS MUSEUM EXHIBIT

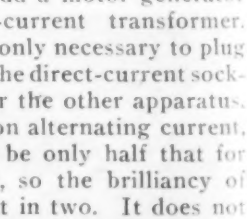
One of the prized possessions of the Chicago historical society is the steering wheel of the "Powhatan," the ship in which Commodore Matthew Perry made his visit to Japan seventy-seven years ago. The visit resulted in negotiations leading to the treaty that opened the island's ports to the world and gave Japan a position among the great nations.

SAP IN TREES OFTEN FREEZES

Sap in trees frequently freezes during the winter, although its freezing point is considerably below thirty-two degrees, since the water in sap also contains various other substances. Trees are further protected by the fact that the moisture content near the surface is not so great in winter as in summer, but in the Canadian woods, when the temperature is forty or fifty degrees below zero, the rupture of tissues in trees caused by freezing can often be heard in the form of sharp reports. As a rule, such freezing results in vertical cracks up and down the trunk. In succeeding seasons, the tree attempts to heal over these ruptures, but layers of scar tissue remain as evidence of the freezing.

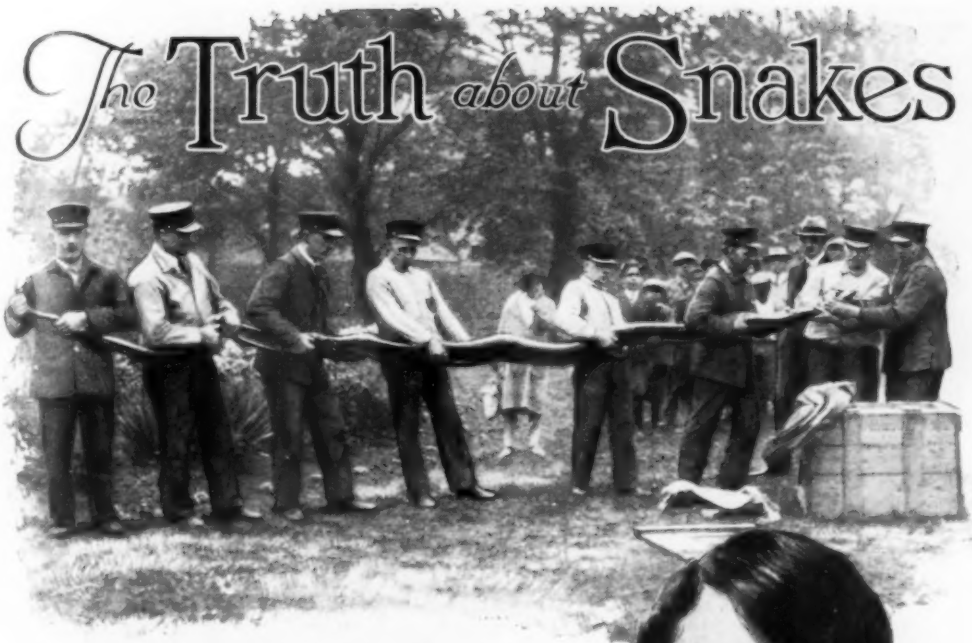
NEON TUBES NOW RUN BY DIRECT CURRENT

Luminous tubes, such as those used for illuminated signs, now may be operated from direct current of 110 to 120 volts with a special transformer, thus making direct-current operation as simple as has been possible heretofore only with alternating current. Previously in direct-current districts, it has been necessary to add a motor generator to the alternating-current transformer. Now, however, it is only necessary to plug the new device into the direct-current socket, substituting it for the other apparatus. It will also operate on alternating current, but the output will be only half that for direct-current work, so the brilliancy of the tubes will be cut in two. It does not interfere with radio sets, and as it has no moving or vibrating parts, does not get out of order and requires no attention. Special bulbs are used in conjunction with its operation.



¶Accident-insurance policies are being dispensed by slot machines in Germany.

The Truth about Snakes



By DON GLASSMAN

THE GREAT order of snakes—more than 1,700 recognized species—sleep with eyes wide open and hear with their tongues.

The average man will find that hard to believe. People revolt at the word "snake," and everybody is willing to whack a serpent if it can be done with impunity. Yet a reptile expert not only finds endless fascination in the lives of serpents, but claims that many species are highly beneficial to mankind, especially those that subsist on rats and frogs.

The curator of reptiles at the New York Zoological Park, Raymond L. Ditmars, stanchly opposes clubbing to death harmless snakes. "In India," says Ditmars, "the death toll from snakes exceeds 20,000 per year, largely because the natives walk barefooted; but serious injury or death from snake bite is very rare in the United States."

A student of snakes all his life, Ditmars has handled venomous and innocuous kinds, large and small. But a long acquaintance with serpents increases his appreciation of their wonder and causes him to speak of his pets sympathetically. Out of his full experience, Ditmars hopes to explode a long train of erroneous theories about snakes. The various rattlesnake species are confined to the New World. Yet the "pit vipers," to which the rattlesnakes belong, are found in both hemispheres. All ten species of the cobra are found in the Old World and not all of them spread a hood. The Elapidæ snakes

Unloading a Twenty-Three-Foot Python, and Wearing a King Snake as a Bracelet

Reptile Garden in Philadelphia Zoo, and Close View of the Fangs of a Rattlesnake

swarm in Australia, which is one of the few parts of the world where poisonous snakes exceed non-poisonous ones. Madagascar is the only large country in warm climate that is entirely free from dangerous serpents.

What distinguishes snakes from most animals is the absence of eyelids. The eyes are ever open, and they can be awakened by "seeing" motion in sleep. Also, snakes have no sign of an external ear. A snake can tune his highly sensitive tongue to receive the faintest sound waves, just as a radio set receives electric waves.

But the snake's expansive jaws are most wonderful. Aside from being able to swallow relatively immense animals, certain species have poisonous teeth, or fangs. Essentially, the snake's fangs are hypodermic needles, and they operate exactly as do those needles used by doctors. When the mouth is closed, the fangs of viperine teeth fold back against the roof; as the jaws open, these dangerous weapons spring out, ready to inject deadly poison.

Although without developed limbs, the snakes can move swiftly and directly. The broad plates on the abdomen are the real organs of locomotion. In crawling, a snake walks upon these plates by bringing them forward in series along the body, then pulling them back again. Most snakes are good swimmers. The tree-dwelling snakes are usually elongated like whips. The subterranean snakes bore their way through earth like worms.

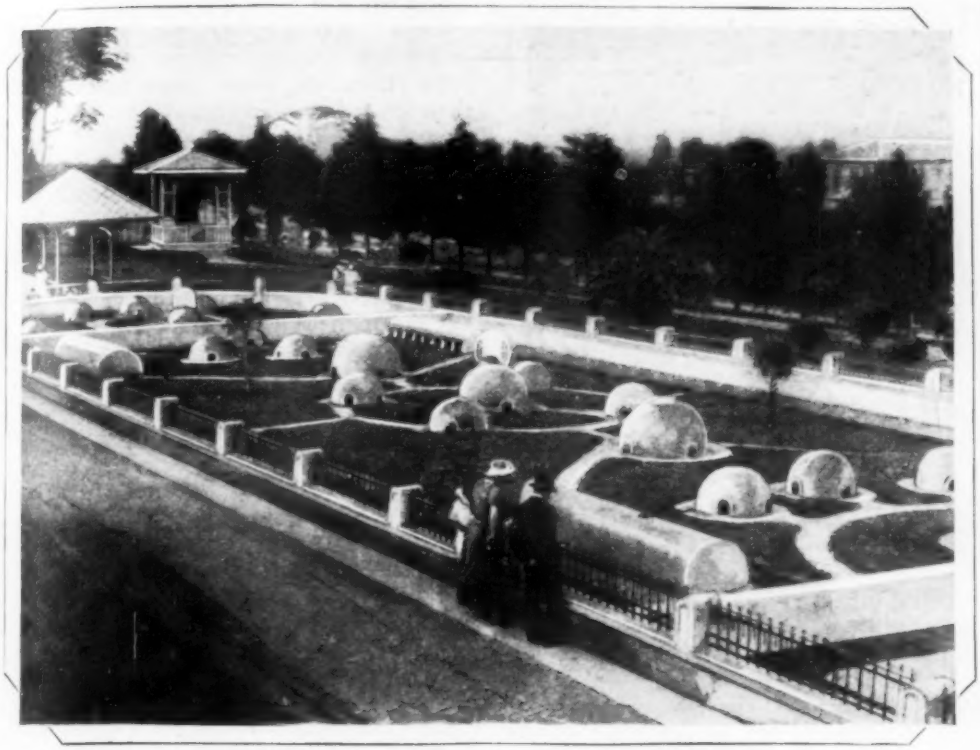
Ditmars believes the regal python is the largest species of serpent, actually reaching a length of thirty feet.

Wherever snakes are found in North America, the garter snake will be among them. It is easily the most abundant species in America. Frogs, toads and earthworms are its principal foods. Water snakes are harmless and should not be confused with poisonous moccasin snakes.

The black snake is also familiar to Americans. It is very agile and skims over rocky surfaces in search of rodents, birds, frogs and the young of other snakes. It will dart away from a man, but when cornered will fight savagely. The black snake is highly beneficial to the farmer.

Ditmars considers "spectacled" cobras the most vicious snakes to be seen in captivity. King cobra is the lion among the serpents. Ditmars considers it the most dangerous of poison-secreting snakes.

The United States is rich in the relative proportion of reptile life within its boundaries. Of the 111 species in the country, seventeen are poisonous. In addition, we have ninety-seven species of lizards, only



Where Poisonous Snakes Are Raised for the Preparation of Serums to Counteract Their Bites; Reptile Gardens and "Bungalows" at Butantan, near Sao Paulo, Brazil

one of which, the gila monster of the southwest, is poisonous.

The coral snake is the most difficult venomous species to distinguish from innocuous varieties. Its skin pattern consists of alternating rings of red and black, the latter bordered by very narrow rings of yellow. Any snake having a rattle is poisonous.

The two North American moccasins, the water moccasin and copperhead, belong to the same subfamily as the rattlesnakes, namely, the pit vipers. On each side of the head, between the ear and eye, they have a deep pit, by which they may be distinguished. Our harmless snakes have round eye pupils; the water moccasin and copperhead have an elliptical—catlike—pupil.

"It is quite wrong to believe," says Ditmars, "that a poisonous snake springs at its enemy. It never jumps from the ground and seldom strikes more than one-third of its length. Poisonous snakes never chase an enemy. Their attitude toward man is entirely that of self-defense. It is impossible to render a venomous snake permanently harmless by extracting the fangs."

Usually a person is bitten on the arm or leg. His safety depends upon how promptly he is treated. A ligature—tight bandage—should be applied directly above the bite. Next, enlarge the punctures, at least as deep as they are. The flow of poisoned blood should be quickened in every way possible. If there are no fresh cuts or abrasions in the mouth, it is harmless to suck venom from the wound. Wash the cuts thoroughly, then bathe in permanganate of potash, dissolved in water until its color resembles deep-red wine.

If a doctor is not available, an anti-toxin called anti-venine, should be injected, preferably under the skin of the abdomen. This antitoxin can be obtained from agencies of the Pasteur institute.

After the wounds have been bled and washed with permanganate, the bandage may be removed, but not before all possible venom has been extracted from the bitten flesh, both by suction and massage.

Binoculars on Roof of Skyscraper Which Visitor May Use after Inserting Coin in a Slot

DIME-IN-THE-SLOT BINOCULARS GIVE VIEW OF CITY

Chicago has a dime arcade on the roof of one of its tallest skyscrapers, conducted on the same principle as the penny arcades of the past. Visitors to the top of the building find binoculars mounted on the walled inclosure, and, by dropping a dime in a slot in one of these instruments, they are able to gain a bird's-eye view of the city and surrounding territory, and to see far out over Lake Michigan.

CAST PORCELAIN AIDS DENTISTS AND REPAIR WORK

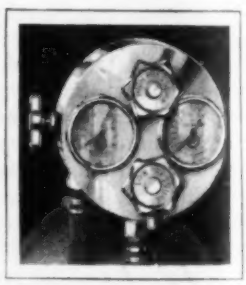
Cast porcelain, possessing all the physical properties of fused porcelain except that it melts and becomes plastic at about 1,500 degrees, now is being employed in dental work. The high temperature can be attained with an ordinary gas-compressed air blowpipe. The material does not become as fluid as gold, but casts with sharp clean margins. It comes in more than a score of shades and also is used for casting small pieces to replace those broken from vases or lamps. Its cost is about one-fifth that of fused porcelain because it can be cast on plaster models, whereas fused porcelain must be built on a platinum matrix, and it can be worked without the aid of the costly electric furnace. Cast porcelain takes a high polish, is unaffected by acids, and can be used with a surface glaze in fifteen shades.

SPEED OF YACHTS INCREASED BY AIR SCIENCE

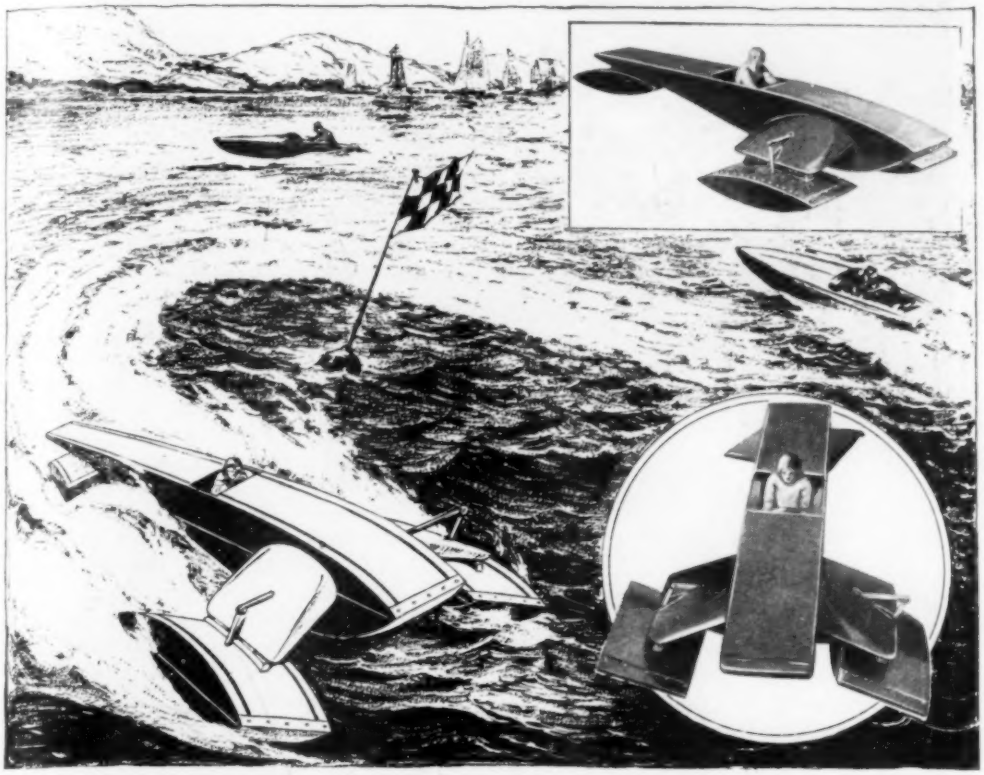
In efforts to wrest more speed from their craft, yachtsmen have been experimenting successfully with various theories of aerodynamics. The discovery during tests in a wind tunnel that planes and boats derive motion not only from the driving pressure on the windward side, but also by being "sucked" forward by the negative pressure on the opposite side, has led to new designs both in airplanes and in yachts. Airplane builders reduced wing surfaces to give the ships more "leading edge" on forward and upper-wing surfaces, thus increasing suction, and yachtsmen accomplished the same end by changing the mainsail next to the mast, trimming it to diminish drag or resistance and add to suction. Yachtsmen also profited from the airplane's slotted wing, the valuable safety device for the flying ship. The yacht with overlapping jib has virtually a slotted wing, although it is used to increase speed by creating additional vacuum, rather than for safety.

BETTER WELDING JOBS ASSURED WITH GAS REGULATOR

Gas pressure delivered in cutting and welding operations is accurately controlled, thereby insuring a constant flame at all times, in a two-stage regulator recently introduced for general commercial use. Special units have been made for this purpose, but this is the first successful attachment for general application. With it, gas is delivered simultaneously to cutting or welding torch if desired, practically no gas is left in the cylinder, and the unit weighs less than the usual single-stage regulator. A new alloy, about one-third as heavy as brass, has been used in its construction. A locknut arrangement is provided to counteract the effect of vibrations that might disrupt the accuracy of the adjustments.



PONTOON-HYDROPLANE PROMISES HIGHER SPEED



Model of a Hydroplane, Which in Reality Consists of Three Small Hydroplanes Operating as a Unit; Drawing Shows How the Forward Pontoon Can Be Banked to Prevent Skidding

Greater safety and stability and steep turns at high speed, without skidding or capsizing, are hoped for in a hydroplane designed by Thomas A. Edison Lake. The accompanying illustrations of a model show some of the chief features. The boat is really three small hydroplanes, joined by a framework. There is three-point contact with the water, to help keep the craft on an even keel. Steering is done with the rear hull and, on quick turns, the two forward pontoons can be banked at an angle, in order to counteract any tendency to skidding.

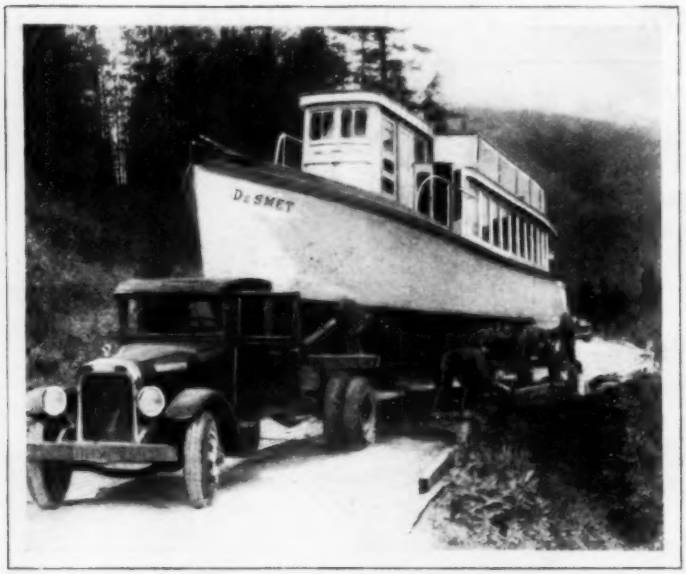
HOG BRISTLES FOR GRASS

Hog bristles set in rubber and tinted green are now being used as a green for portable miniature golf courses, the bristles slowing up the ball almost like real grass turf. While the first cost is greater than for the artificial greens of flax straw or cottonseed hulls, it lasts longer and requires no upkeep. High heels will not cut it, and the hog-bristle grass comes in light layers easily handled.

SILENT VIOLIN FOR BEGINNERS HAS NO SOUNDING BOARD

P. & A. ©

Intended particularly for beginners, a "silent violin" has been so constructed that only the player can hear the notes. It is built along conventional lines without any sounding boards. Since there is no amplification, the notes produced are faint.



A Sixty-Foot Cabin Cruiser, with Room for 125 Passengers, Being Taken over the Continental Divide on a Motor Truck

CRUISER GOES OVER MOUNTAIN ON A TRUCK TRAILER

Transporting a sixty-foot cabin cruiser from the point in Montana where it was built to a mountain lake in Glacier national park recently offered a difficult problem for the owners until a motor truck and trailer was pressed into service. The truck hauled the boat, capable of carrying 125 passengers, through the mountains without mishap to the point where it was to be placed in its native element. During the trip the craft was taken across the continental divide.

CANDLES IN BALLOONS BANNED AS FOREST-FIRE HAZARD

Weathermen in California, who have been accustomed to finding the direction and velocity of winds aloft by sending up small balloons equipped with little lanterns carrying tallow candles to make them visible at night, have been ordered to stop this practice because of the danger of starting forest fires. The balloons used for this night-observation work burst and the protected candle falls, often burning until it reaches the ground. Airmen will be deprived of the reports until a safe light is found.

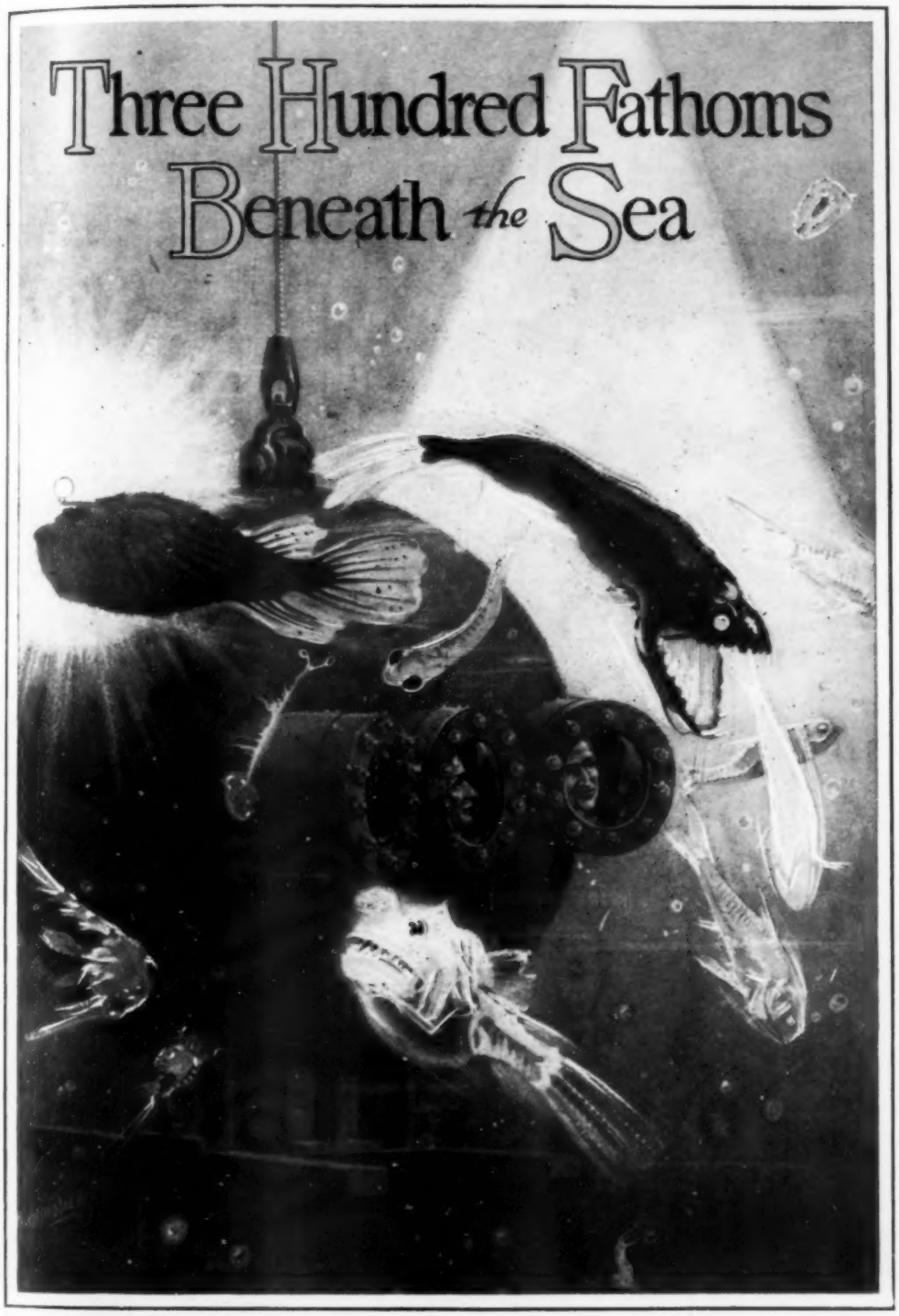
GASOLINE MADE FROM TAR

Gasoline can be produced from natural tar sands found in western Canada, chemists of the University of Alberta report. The sands lie in strata, similar to the beds of oil fields except that the compounds do not contain so much liquid material as would be necessary for it to flow out of the sands and be useful. It is possible, however, to extract the oils by a chemical process known as "hydrogenation," now employed in Germany to make oils from low-grade brown coal. It requires enormous quantities of hydrogen gas which is combined with the tar so that it is converted into the constituents of fluid oils or gasoline, the atoms of hydrogen combining with the molecules of the tarlike substance to produce the change. A source of the hydrogen has been found in the natural gas wells of the same region.

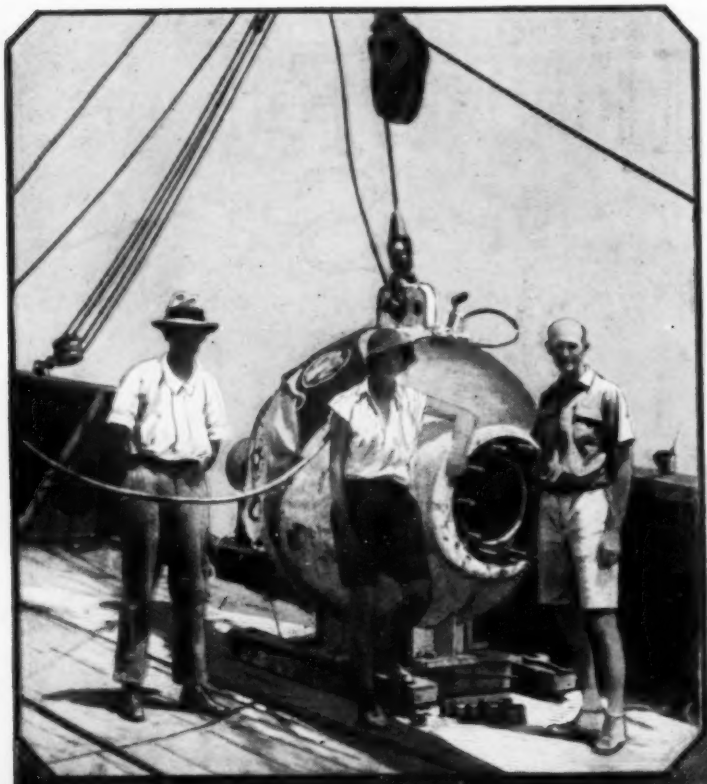
NEEDLE THREADER SAVES TIME OF BUSY HOUSEWIFE

To save the time and patience of the busy housewife, a simple needle threader is available with which needles having even the finest eyes are quickly threaded. It consists of a round piece of metal to which is attached a fine steel wire, bent to diamond-shape with the long end tapering to a point. The point is pushed through in the eye beyond the diamond-shaped section. The thread end is then pushed between the spread wires and the threader withdrawn, pulling the thread with it through the eye.

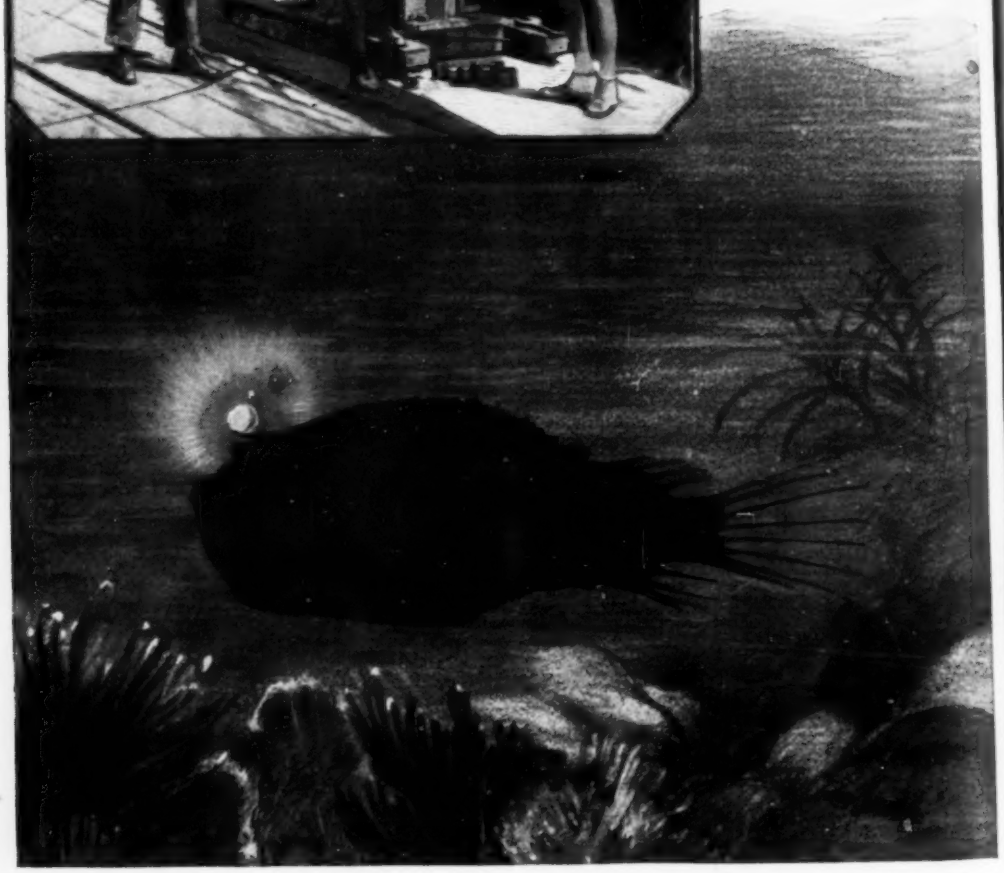
Three Hundred Fathoms Beneath the Sea



Two-Ton Steel Chamber, Six Feet in Diameter, in Which William Beebe and Otis Barton, His Assistant, Descended to a Depth of 1,426 Feet below the Surface of the Sea



Left to Right, John Lee Van, Gloria Hollister and William Beebe, Standing beside the Diving Sphere, and, Below, an Underwater Torch Bearer, a Creature Found 800 Fathoms Deep; the Projecting Tentacle on Its Head Carries a Glowing Luminous "Lamp" That Lights the Way; the Portholes of the Diving Chamber Are Fitted with Strong Fused-Quartz Glass; the Interior of the Sphere Is Kept at Sea-Level Pressure, While the Exterior Is Subjected to a Pressure of About 20,000 Pounds to the Square Inch at a Depth of 1,400 Feet; an Oxygen Reserve Is Depended Upon for the Air Supply inside the Chamber, and Communication Is Carried on with the Ship by Telephone; Mr. Beebe Remained Down Half an Hour at a Depth of 1,400 Feet



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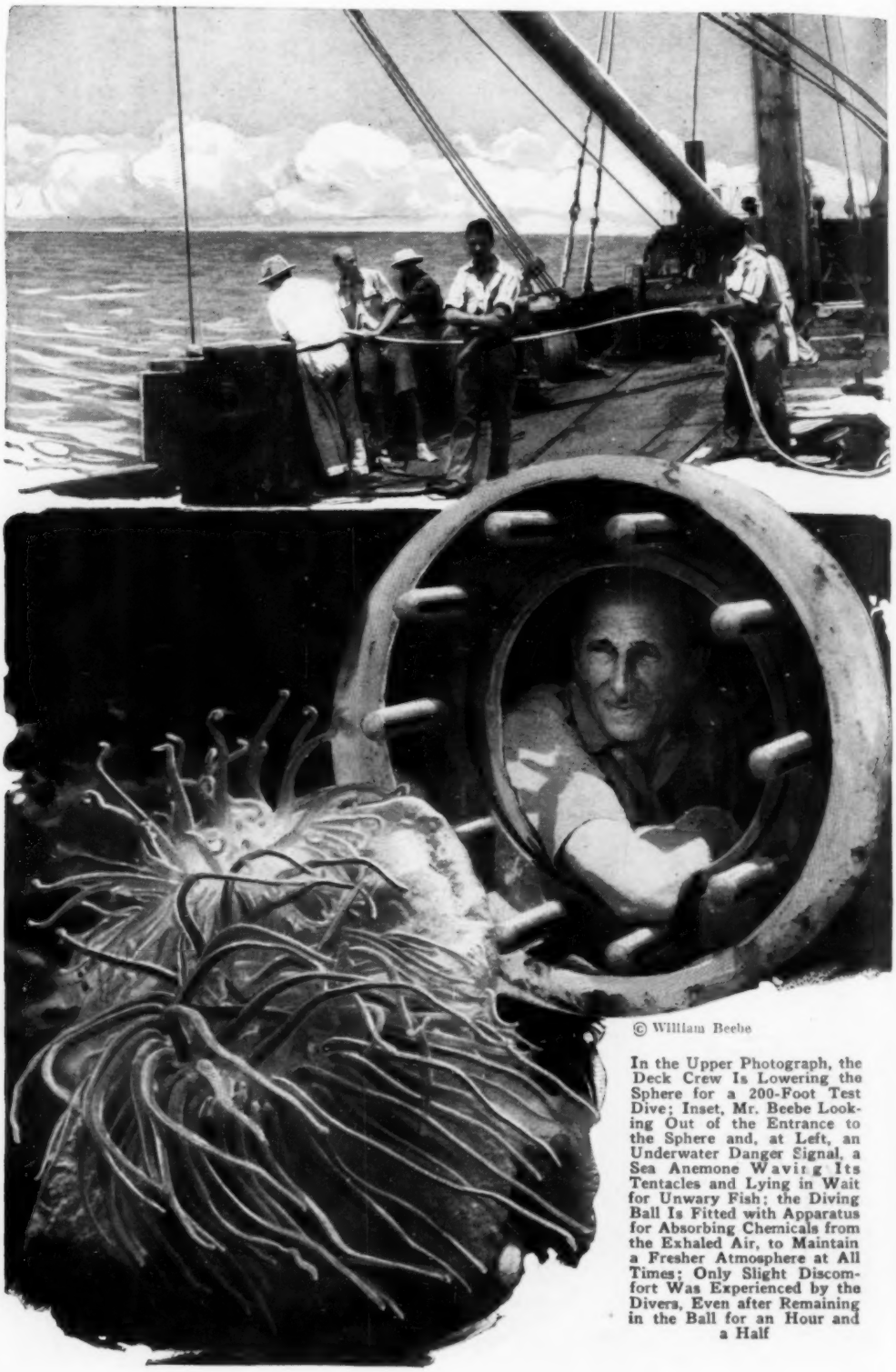
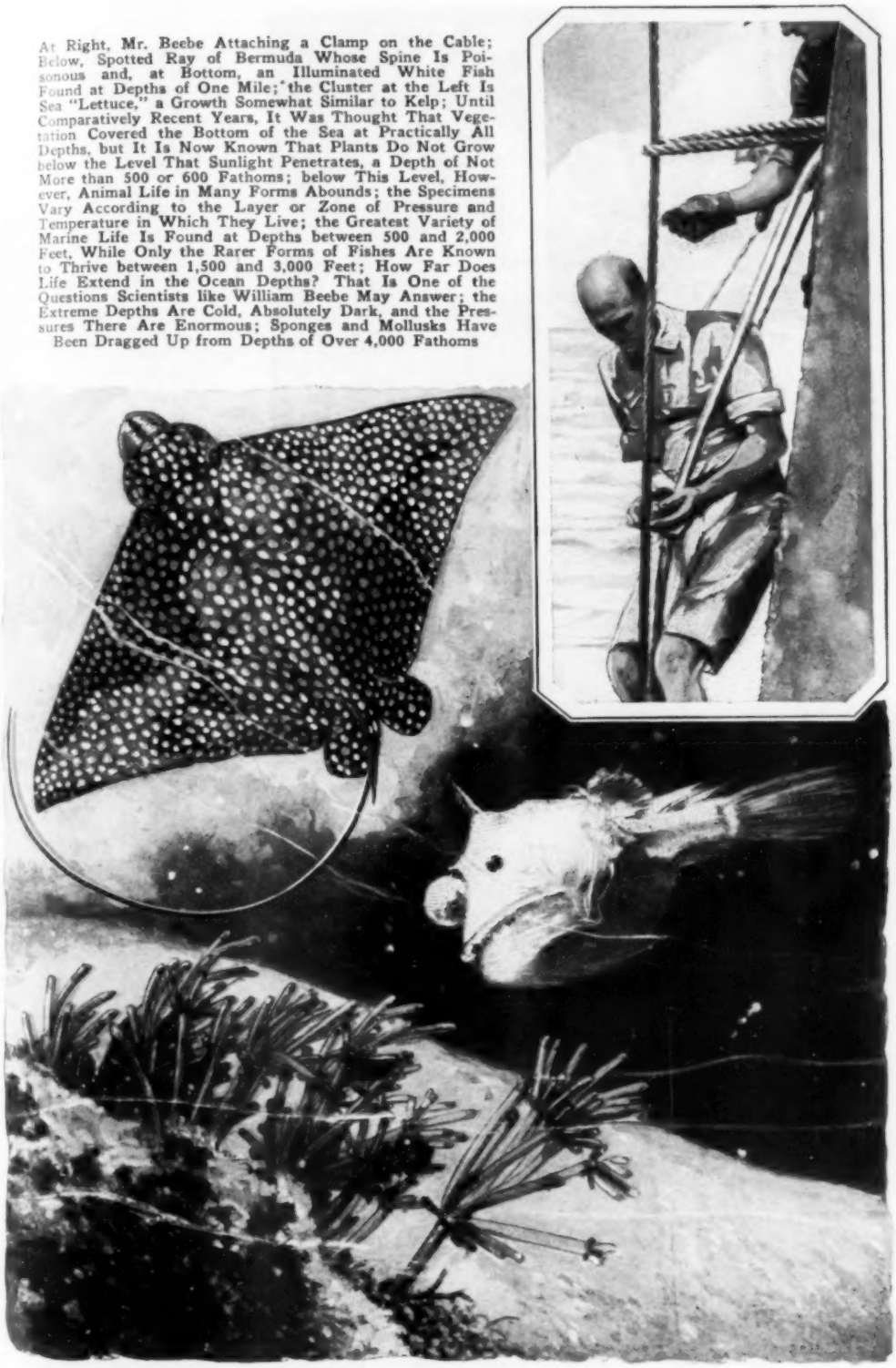
The Diving Chamber Being Lowered from the Ship by Its Strong Steel Hawser; Electric Cables Are Connected to Provide Current for the Lamps inside the Ball and to Illuminate the Submarine Darkness Outside; at Right, Pilot Joseph Millet and William Beebe at the Wheel of the "Ready," the Service Ship; Explorer Beebe's Submarine Adventures Are Doing Much to Give the World Authentic Information about the Ocean Depths; He Has Obtained Many New and Interesting Forms of Submarine Life for Other Scientists to Study; How Animals Adapt Themselves to the Depths Is One of the Interesting Sidelights of Deep-Sea Study



© William Beebe

In the Upper Photograph, the Deck Crew Is Lowering the Sphere for a 200-Foot Test Dive; Inset, Mr. Beebe Looking Out of the Entrance to the Sphere and, at Left, an Underwater Danger Signal, a Sea Anemone Waving Its Tentacles and Lying in Wait for Unwary Fish; the Diving Ball Is Fitted with Apparatus for Absorbing Chemicals from the Exhaled Air, to Maintain a Fresher Atmosphere at All Times; Only Slight Discomfort Was Experienced by the Divers, Even after Remaining in the Ball for an Hour and a Half

At Right, Mr. Beebe Attaching a Clamp on the Cable; Below, Spotted Ray of Bermuda Whose Spine Is Poisonous and, at Bottom, an Illuminated White Fish Found at Depths of One Mile; the Cluster at the Left Is Sea "Lettuce," a Growth Somewhat Similar to Kelp; Until Comparatively Recent Years, It Was Thought That Vegetation Covered the Bottom of the Sea at Practically All Depths, but It Is Now Known That Plants Do Not Grow below the Level That Sunlight Penetrates, a Depth of Not More than 500 or 600 Fathoms; below This Level, However, Animal Life in Many Forms Abounds; the Specimens Vary According to the Layer or Zone of Pressure and Temperature in Which They Live; the Greatest Variety of Marine Life Is Found at Depths between 500 and 2,000 Feet, While Only the Rarer Forms of Fishes Are Known to Thrive between 1,500 and 3,000 Feet; How Far Does Life Extend in the Ocean Depths? That Is One of the Questions Scientists like William Beebe May Answer; the Extreme Depths Are Cold, Absolutely Dark, and the Pressures There Are Enormous; Sponges and Mollusks Have Been Dragged Up from Depths of Over 4,000 Fathoms



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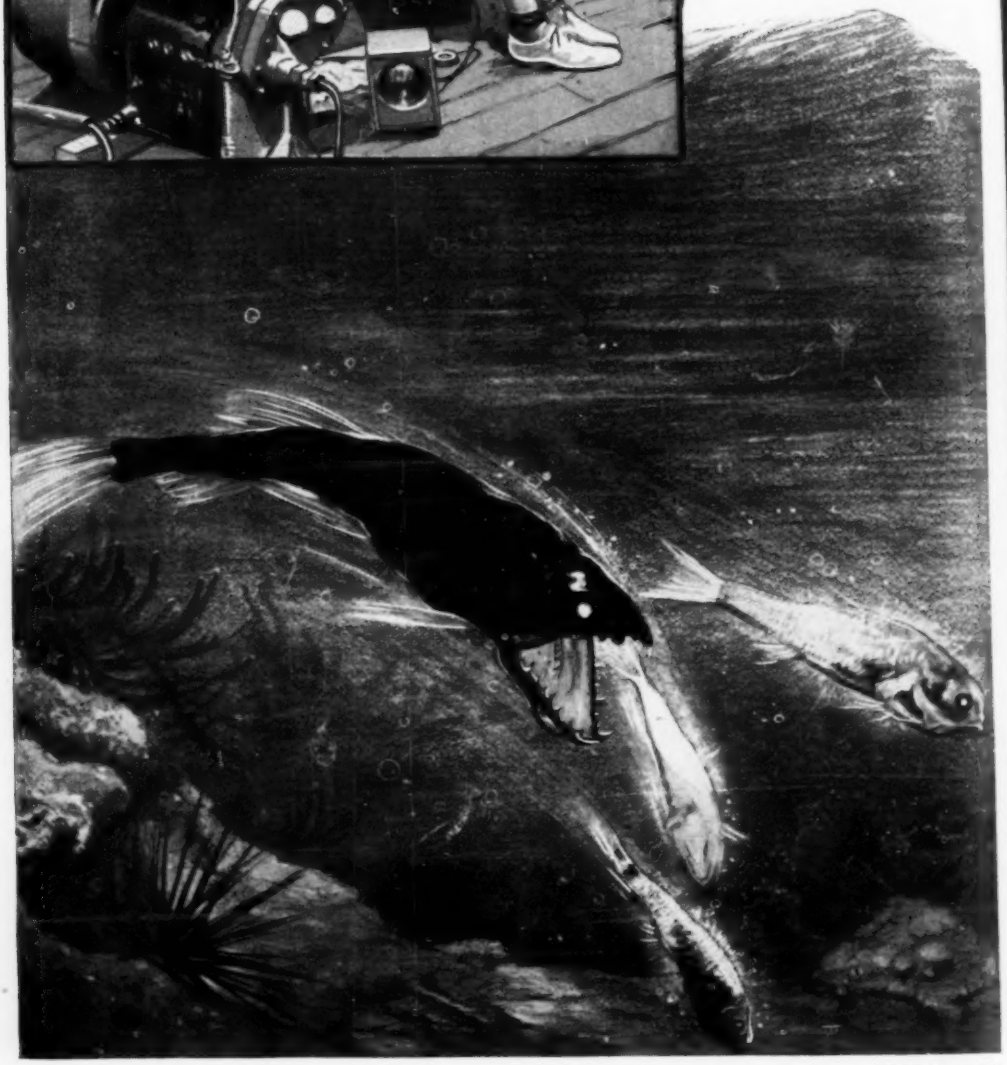
Gloria Hollister at the Telephone Connected to the Diving Sphere, and, Below, the "Eater of the Stars," a Black Fish of Voracious Appetite, Pursuing Its Luminous Prey on the Surface of the Ocean at Night; Mr. Beebe Plans Dives to Greater Depths Than He Has Yet Reached; Engineers Believe That a Ball Can Be Built to Go Down to Depths of Half a Mile without Difficulty; with Every Fathom, the Pressure Increases Until, at 5,000 Fathoms, About the Greatest Known, It Becomes Approximately Six Tons to the Square Inch



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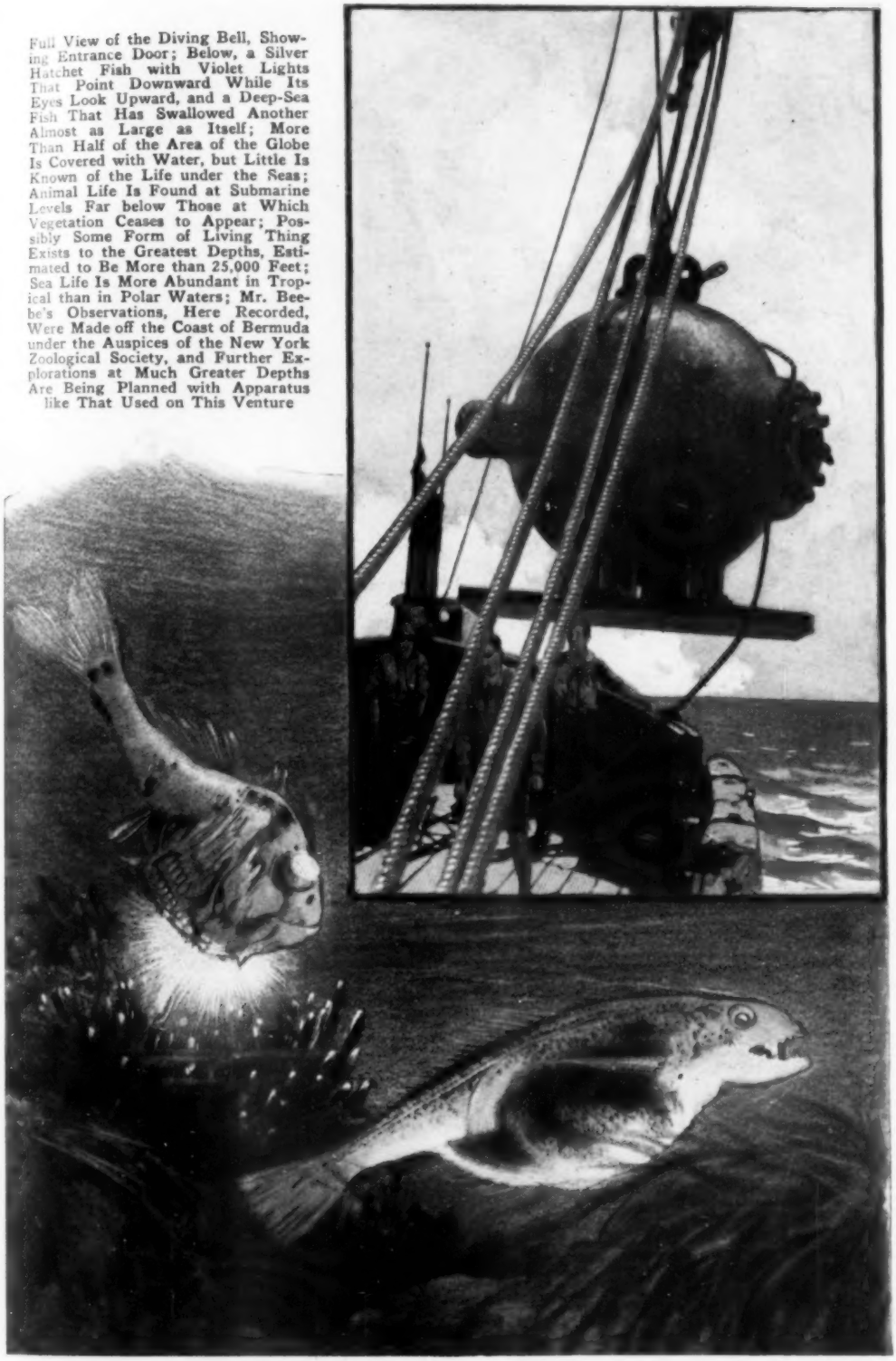
Full View of the Diving Bell, Showing Entrance Door; Below, a Silver Hatchet Fish with Violet Lights That Point Downward While Its Eyes Look Upward, and a Deep-Sea Fish That Has Swallowed Another Almost as Large as Itself; More Than Half of the Area of the Globe Is Covered with Water, but Little Is Known of the Life under the Seas; Animal Life Is Found at Submarine Levels Far below Those at Which Vegetation Ceases to Appear; Possibly Some Form of Living Thing Exists to the Greatest Depths, Estimated to Be More than 25,000 Feet; Sea Life Is More Abundant in Tropical than in Polar Waters; Mr. Beebe's Observations, Here Recorded, Were Made off the Coast of Bermuda under the Auspices of the New York Zoological Society, and Further Explorations at Much Greater Depths Are Being Planned with Apparatus like That Used on This Venture



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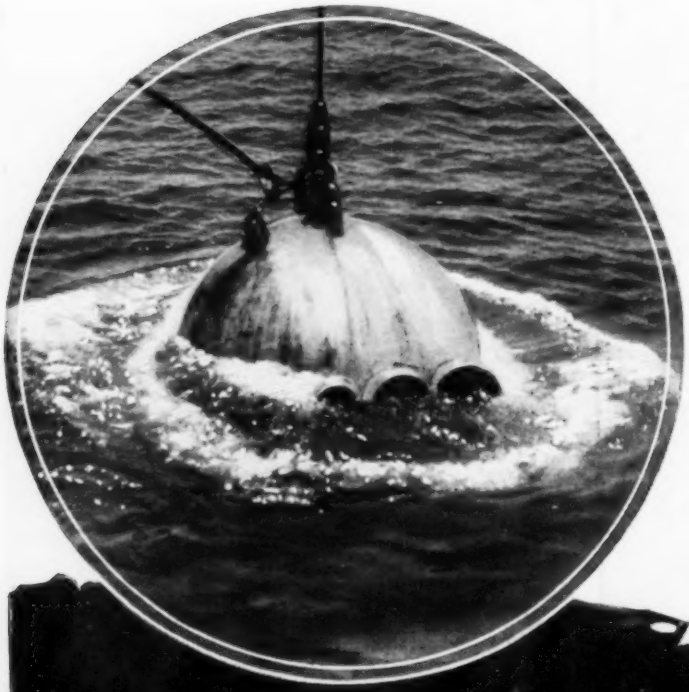

Lowering the Diving Sphere for a Test Dive, and Odd Specimens of Sea Life Dragged Up in Nets from Great Depths; the Curious Little Creatures Fought and Devoured Each Other Until the Very Last and Were Aglow with White, Yellow and Pink Lights; Until Recently, Scientists Were Dependent upon Hooks and Nets to Obtain Specimens from the Deep, but Today, with the Diving Bell, the Submarine Camera, Powerful Lights and Telephones, Observers Are Able to Visit the Depths and There Study and Record the Life Discovered in Its Natural Habitat; Besides the Wide Interest in the Strange Forms of Life from the Deep, There Is an Economic Appeal Also for the Ocean Depths May Yield Hitherto Unsuspected Riches in Foods and Chemicals

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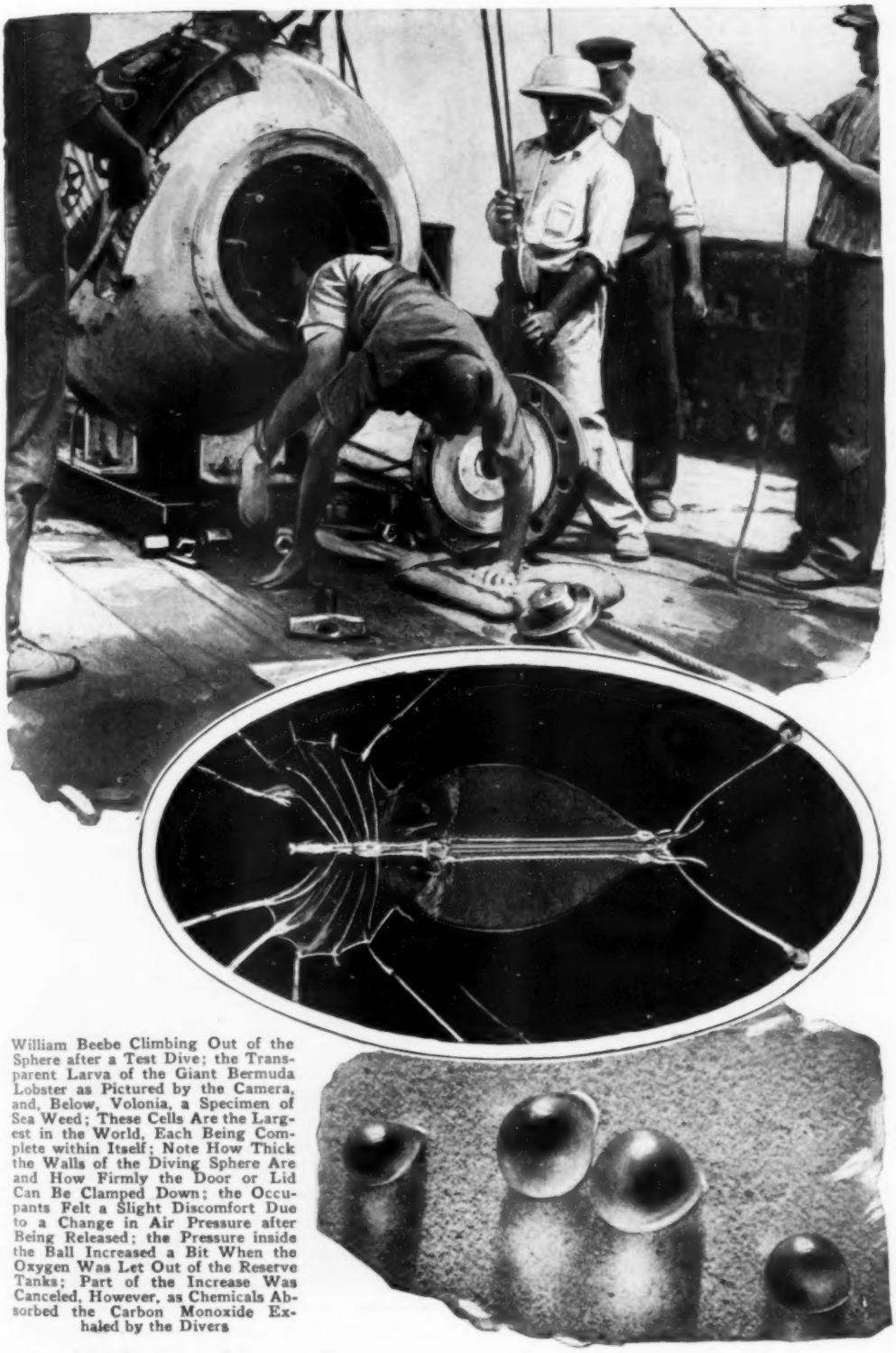
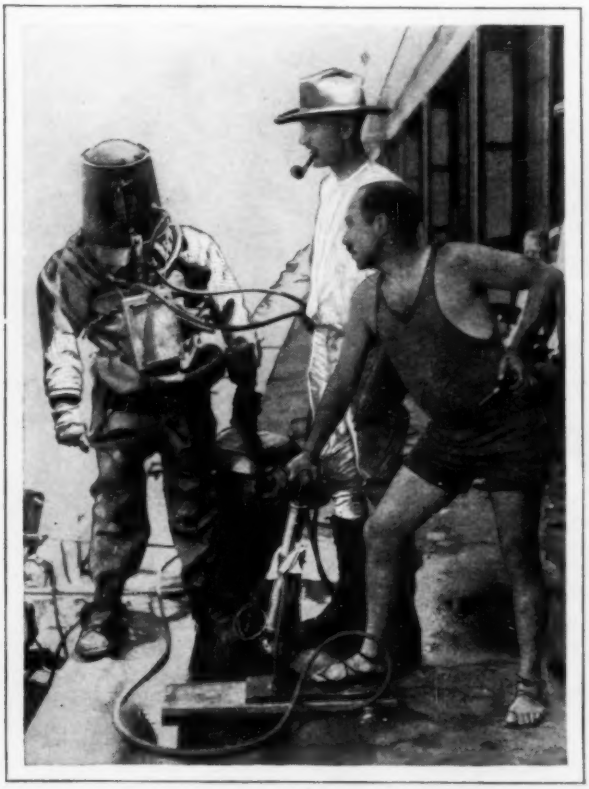


William Beebe Climbing Out of the Sphere after a Test Dive; the Transparent Larva of the Giant Bermuda Lobster as Pictured by the Camera, and, Below, Volonia, a Specimen of Sea Weed; These Cells Are the Largest in the World, Each Being Complete within Itself; Note How Thick the Walls of the Diving Sphere Are and How Firmly the Door or Lid Can Be Clamped Down; the Occupants Felt a Slight Discomfort Due to a Change in Air Pressure after Being Released; the Pressure inside the Ball Increased a Bit When the Oxygen Was Let Out of the Reserve Tanks; Part of the Increase Was Canceled, However, as Chemicals Absorbed the Carbon Monoxide Exhaled by the Divers

© William Beebe



Homemade Diving Suit Constructed from Old Automobile Inner Tubes and a Few Other Odds and Ends of Material

A DIVING SUIT OF INNER TUBES KEEPS OUT THE WATER

Two Chicago divers recently constructed a diving suit of odds and ends of material found about their workshop, relying on old inner tubes from automobile tires for most of it. One of the men donned the completed suit and went down in sixty feet of water, emerging to declare the homemade outfit entirely successful.

TREES USE BARREL OF WATER A DAY IN SUMMER

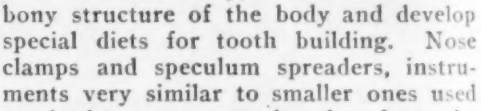
Trees need large quantities of water to keep them in healthy condition. An apple tree thirty years old gives off about a barrel of water a day in summer, and a good-sized birch gives off twice that much on a hot day. A single oak is known to have given off into the air in the form of vapor more than 100 tons of water in one growing season.

PLANT DISEASES COST BILLIONS A YEAR

Plant diseases are responsible for a loss amounting to about $1,500,000,000 annually in the United States, according to estimates of Dr. R. J. Haskell, in charge of the plant-disease survey. In Canada, the loss is estimated at $45,000,000 and England's loss is calculated at one-tenth the value of its plant products. The American wheat crop is reduced by about 97,000,000 bushels a year through rusts, root rots, smuts and other infections, while the corn crop is curtailed approximately 271,000,000 bushels and potatoes by about 95,000,000 bushels. The banana industry also is threatened by a fungus known as the Panama disease.

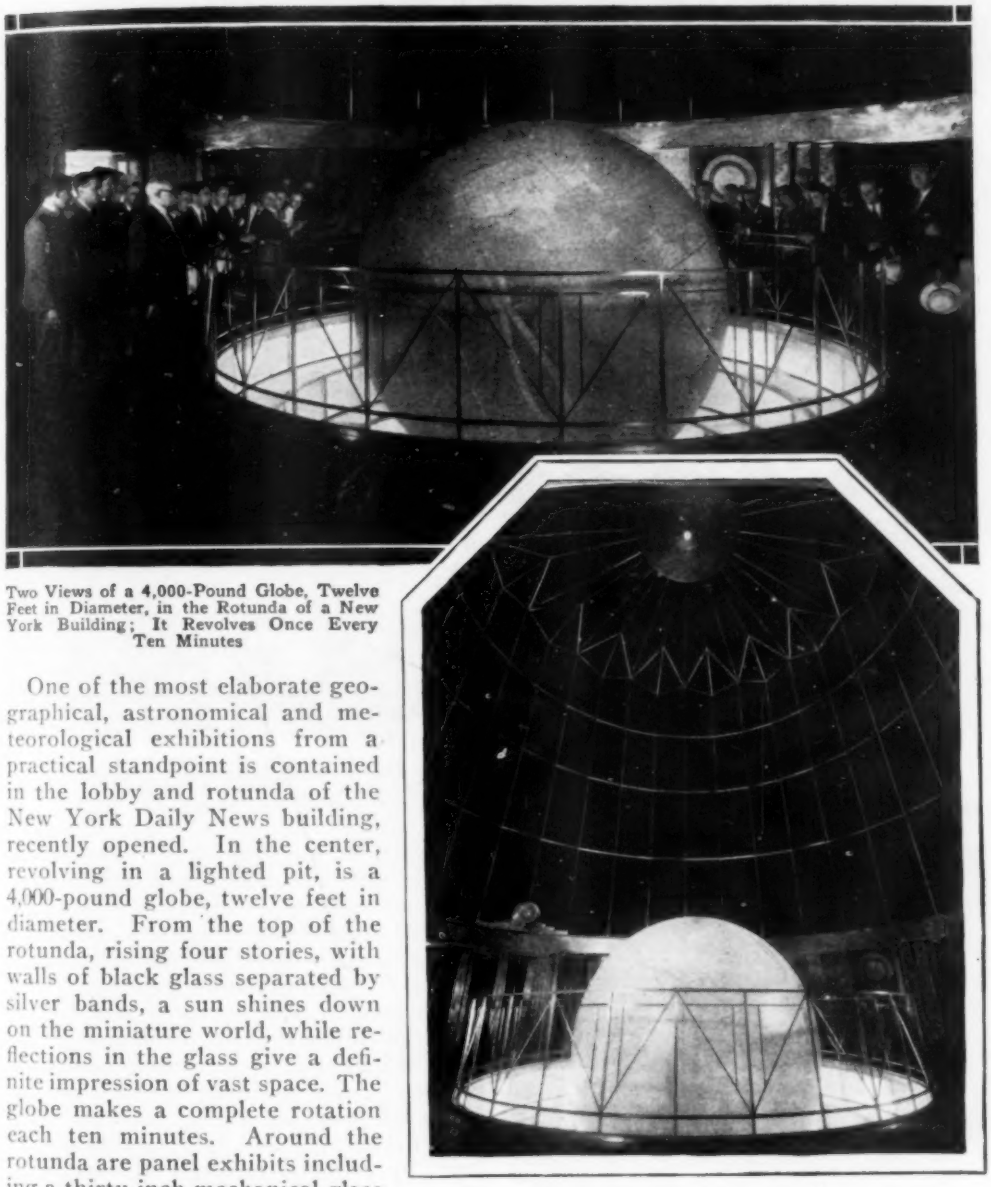
ANIMAL DENTISTRY AIDS IN FINDING CAUSES OF TOOTH DECAY

Experiments with cows, hogs and monkeys aid the scientists of dentistry to discover the causes of tooth decay, find defects in the bony structure of the body and develop special diets for tooth building. Nose clamps and speculum spreaders, instruments very similar to smaller ones used on the human, are employed to force the animals to keep their mouths in proper position for dental examination.



Examining a Cow's Teeth for Defects; Studying the Teeth of Animals Aids Dental Science

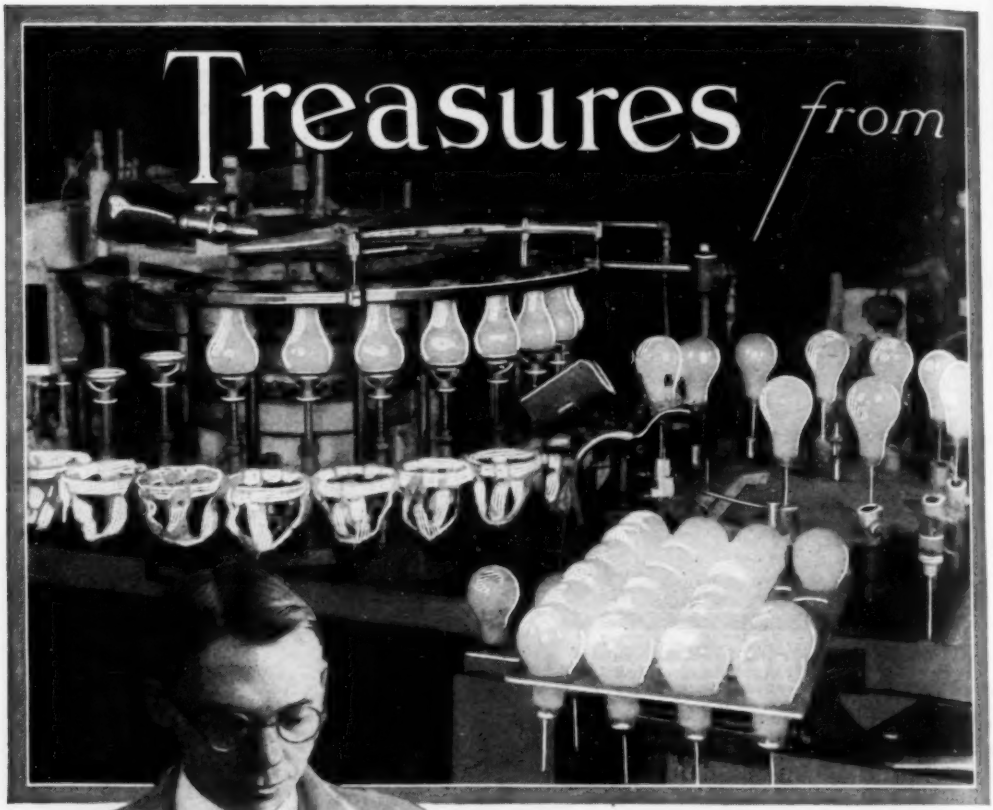
WORLD IN MINIATURE SHOWN IN BUILDING LOBBY



Two Views of a 4,000-Pound Globe, Twelve Feet in Diameter, in the Rotunda of a New York Building; It Revolves Once Every Ten Minutes

One of the most elaborate geographical, astronomical and meteorological exhibitions from a practical standpoint is contained in the lobby and rotunda of the New York Daily News building, recently opened. In the center, revolving in a lighted pit, is a 4,000-pound globe, twelve feet in diameter. From the top of the rotunda, rising four stories, with walls of black glass separated by silver bands, a sun shines down on the miniature world, while reflections in the glass give a definite impression of vast space. The globe makes a complete rotation each ten minutes. Around the rotunda are panel exhibits including a thirty-inch mechanical glass globe, utilizing internal illumination to show the daily, seasonal and annual aspects of the earth and sun, a calendar arrangement showing moon rise and set in all phases and at all altitudes, a map of the United States, Mexico, West Indies and portions of Canada, showing railways, time-zone boundaries, air-mail routes, passenger and express air routes and lighted airways. In addition there is also a standard time-zone clock, showing simultaneous times in all zones, the principal cities in each zone, and denoting, by shading, dawn, dusk, night and day throughout the world. A weather map of the entire northern hemisphere shows average weather conditions for the United States, Europe and the Atlantic ocean.

Treasures *from*



Filling Electric-Light Bulbs with Argon and Nitrogen, and, Left, Quartz Hot-Cathode Neon Lamp for Aircraft Beacon

MAN'S dependence upon the atmosphere as a source of things necessary to his existence and conducive to his comfort is an old story. From this source he has always obtained oxygen for breathing and for the combustion of fuel; carbon, gleaned from the air by plants and used by man as fuel and food; his entire water supply, fed from the clouds to the streams as rain and snow, and compounds of nitrogen, essential to the fertility of the soil, formed from the free nitrogen of the air partly through the action of lightning and partly through minute organisms.

Only recently, however, has he begun to draw upon the air for blessings not supplied by the spontaneous processes of nature. Today he looks upon the air as a mine of precious substances obtainable, like the metals and minerals under his feet, by artificial methods of extraction. Some of these substances were not even known to exist until about a generation ago.

The discovery of the so-called "rare" gases of the atmosphere, made in the last decade of the nineteenth century, was a startling scientific event, though its important practical bearings were not realized at the time. Argon, the most abundant of these gases, forms nearly one per

the Air

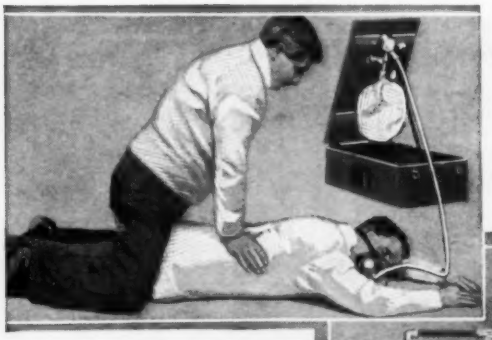
cent of the air by volume—while the mass, or weight, of all the argon in the atmosphere is about five times that of all the water vapor—so that the fact that it escaped detection until the year 1894 seems astonishing. The other rare atmospheric gases discovered at the same period—helium, neon, krypton and xenon—form very minute fractions of the atmosphere, but their rarity is only relative. Xenon, the rarest of all, is present in a sample of air only to the trifling extent of nine parts in a hundred

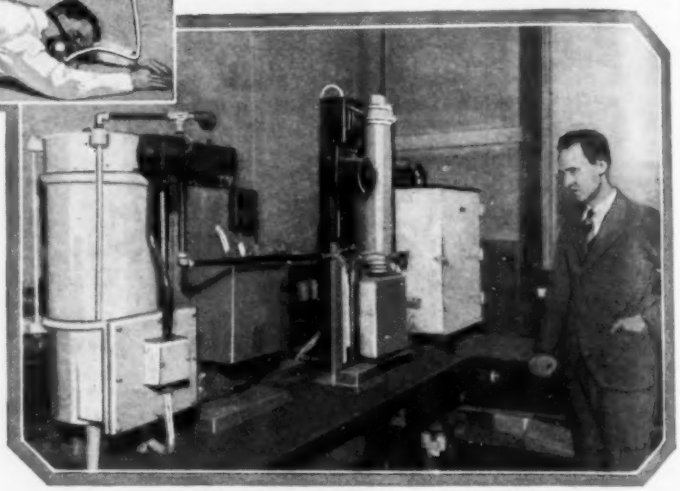
Splitting Piece of Wood with Tung Oil Frozen in Liquid Air, and a Cloud of Liquid Air

million, by volume, but the total amount of this gas in the atmosphere is something like 1,874,000,000 tons.

For some years after their discovery, the five gases mentioned were mere chemical curiosities. Argon was the only one that could then be obtained in appreciable quantities except at enormous cost, and no important industrial uses were foreseen for any of them. At present, through methods since devised, argon, neon and helium are obtained on a large scale and valuable applications have been found for them. Argon and neon are extracted entirely from the air and a small amount of helium is also obtained from that source, though the principal supply comes from certain grades of natural gas.

The chief means of mining the air for both common and rare gases is the liquid-air process. Air is, in one respect, much like petroleum. It is a mixture of several substances, which are not chemically combined with one another, and which, on





Reviving Drowning Victim with Oxygen, and Testing Textile Fibers with Ozone in Westinghouse Laboratories by Newly Introduced Process

account of boiling or vaporizing at different temperatures, can be separated by the procedure known as "fractional distillation." The chemist runs petroleum through a still and thus obtains gasoline, kerosene, heavy oils, paraffin and other distillates. In order to treat air in a similar way, he must first liquefy it by subjecting it to high pressure and an extremely low temperature.

Liquid air had ceased to be a novelty at the beginning of the present century, but although it was then one of the most interesting substances known to mankind on account of the remarkable experiments that could be performed with it, there seemed to be little prospect of turning it to account in a commercial way. In fact, the men who had lately perfected methods of liquefying air in quantity at low cost were trying in vain to find profitable markets for their product.

Finally, in 1901, Linde invented a process of distilling liquid air as a means of separating it into its constituents, and this was the foundation of the great liquid-air industry that now exists. Liquid air itself has never become an important article of commerce, but billions of cubic feet of it are now prepared every year at plants where it is immediately distilled and thus made to yield products of commercial value.

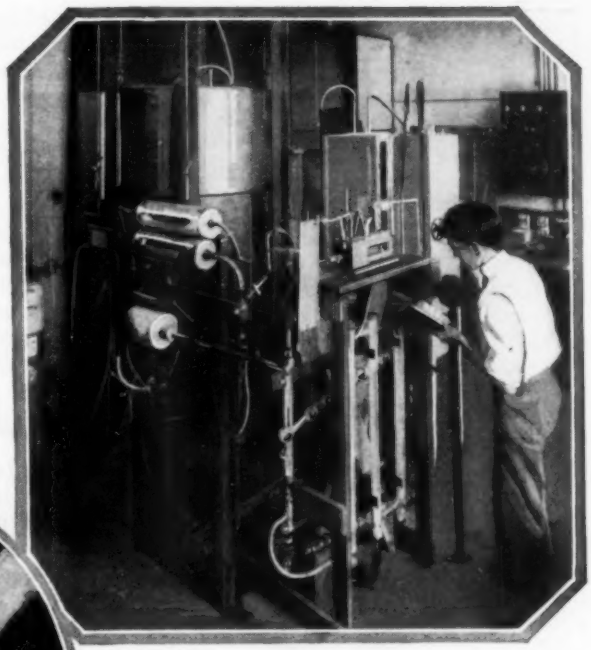
The main product of this industry is oxygen. This gas is needed for a variety of purposes, but by far the largest part of the commercial output, amounting at present to more than 5,000,000,000 cubic feet a year, is employed for the welding and cutting of metals by means of the oxyacetylene torch.

A use of more recent origin is for blasting. In this case the oxygen is employed in liquid form. Cartridges filled with lampblack, powdered charcoal or carbon in some other form, are soaked in the liquid shortly before use, and the mixture is known as "liquid-oxygen explosive"—alias L.O.X. This blasting material is far more effective than dynamite and the other older explosives, owing to the fact that the oxygen, being in an uncombined form, is ready to unite instantaneously with carbon or other elements present. It is also exceptionally safe, as, because of the rapid evaporation of the oxygen, a cartridge automatically becomes dead within an hour or so after it is made.

Nitrogen, which forms nearly four-fifths of the atmosphere, is separated in corresponding proportion by the liquid-air process, but most of it is allowed to escape, though some is saved and used industrially. The bulk of the atmospheric nitrogen needed for fixation processes is obtained by other methods.

Pure nitrogen was used for a time in filling tungsten-filament electric lamps. The pressure of an inert gas permits the filament to be operated at a high temperature, and thus to give a brilliant light,

without disintegrating, but a mixture consisting of argon with a small percentage of nitrogen has now been found to be best for this purpose and is used in about half of all the electric lamps at present manufactured. Gas-filled lamps are more economical of current and much longer-lived than vacuum lamps, and it is estimated that the use of argon in this connection saves the American people $300,000,000 a year in electric-light bills. Argon is also employed to some extent for filling radio tubes, though not so widely



Above, Right, Purifying Argon for Electric Lamps, and Pouring Liquid Air to Freeze Rubber Tubing

as helium or neon. All the argon used industrially is obtained from liquid air.

Neon has become very familiar in this country through the thousands of neon tubes that have recently been installed for advertising and other display purposes. These tubes contain neon and glow with a vivid orange-red light when an electric current is sent through them. A wide range of colors is now secured through the addition of other gases and chemicals and the use of special kinds of glass.

Krypton and xenon possess properties that make them superior to argon for filling electric-light bulbs, but the difficulty of obtaining them in quantity has hitherto prevented their use for this or any other industrial purpose.

Nitrogen, as we have already stated, is easily extracted from the atmosphere—which contains upward of 20,000,000 tons of it over every square mile of the earth's surface—but a more difficult problem is to make this relatively inert gas enter into chemical combinations, forming substances, such as ammonia and nitrates.

One more substance that mankind obtains by artificial means from the atmosphere is ozone. This modification of oxygen is valuable for sterilizing water and for a wide range of industrial purposes requiring a powerful oxidizing agent. Practically none of it is present naturally and permanently in the lower atmosphere (though a wonderful "ozone blanket" has been discovered many miles above the earth), but it is produced from atmospheric oxygen by sending a brush discharge of electricity through dry air.

The business of mining the atmosphere is in its infancy. As compared with many other natural resources that may fail in the near future, the supply of the atmospheric gases is practically inexhaustible. New methods of tapping the supply will undoubtedly be found.

More and more, in the years to come, will man gather wealth from the air. He may even, some day, solve the perennial problem of rain making!

Wire Suit of Armor for the Protection of Boys Retrieving Golf Balls on a Driving Range

WIRE SUIT OF ARMOR SHIELDS GOLF-BALL RETRIEVER

Boys who retrieve golf balls on a Los Angeles driving range are protected from injury by a wire framework somewhat resembling a suit of armor. The wire covers head, shoulders and the entire upper part of the body, leaving only arms and legs exposed.

OVERSHOES GO HUNDRED MILES BEFORE WEARING OUT

Walking tests conducted by a rubber company reveal that the average pair of overshoes is good for about 100 miles of walking before being consigned to the junk box, and some zipper and shower boot types worn by women have gone 400 miles before breaking down. Mileage tests for rubbers and galoshes are conducted along lines similar to the experiments with automobile tires. Four young women, each wearing a different type of rubber shoe, walk eighteen miles a day over brick, concrete, cinders and gravel, the course being over a measured circuit two miles long. The girls make the first trip in about half an hour, but the last journey takes nearly twice that time. Often a girl is wearing a black shoe on one foot and a gray one on the other. Each time a new compound or new construction feature is incorporated in the shoes, rigid walking tests reveal the exact degree of success before they are placed on the market.

OWLS FIGHT RANCHERS' ENEMY

Sixteen species of owls inhabit North America, the great horned owl being the most powerful. This bird is a friend of the western rancher, since it preys on pocket gophers, one of the rancher's worst enemies. It also is a terror to the varying hare, aiding the lynx and other predatory animals in keeping this little animal in check.

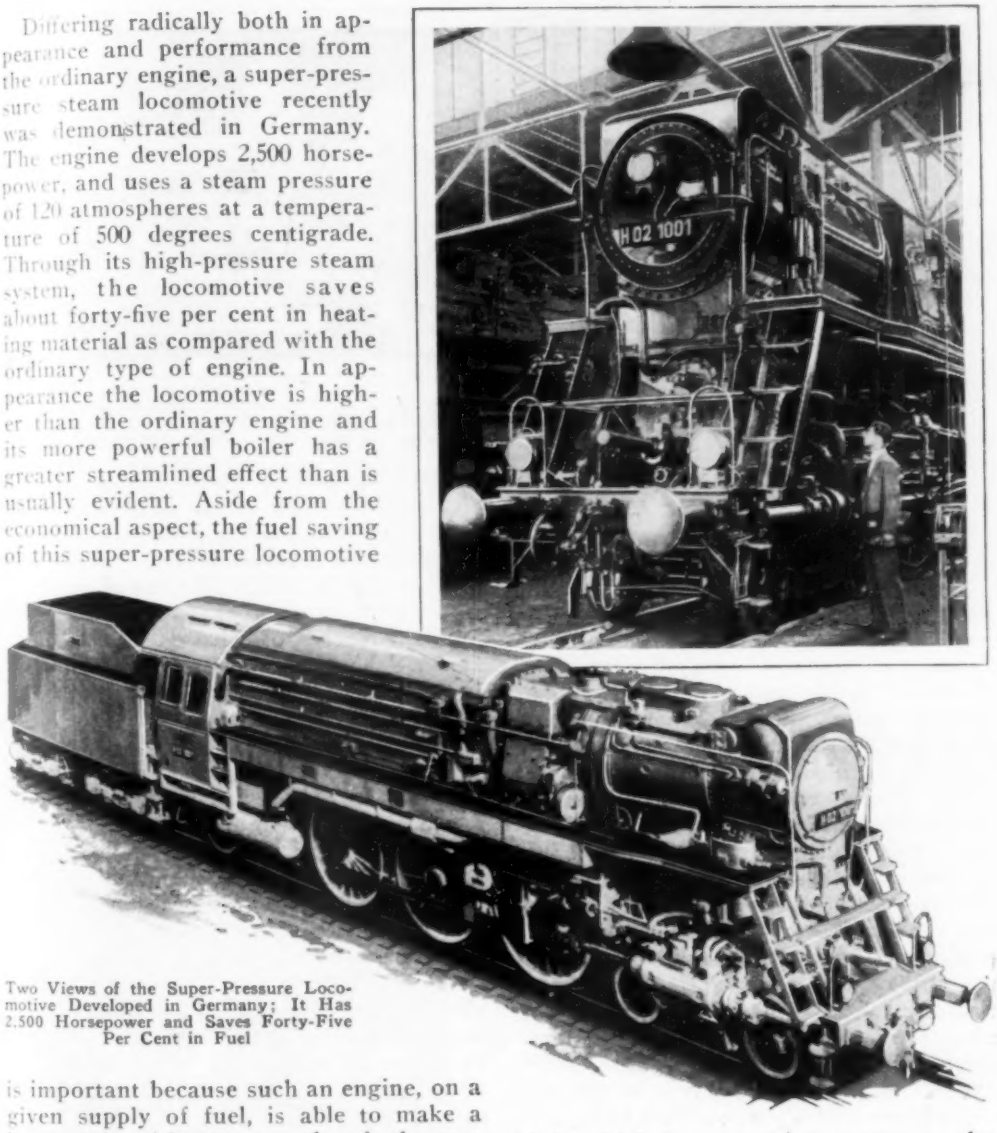
WAIST AND ANKLE CLIPS HOLD AUTO ROBE IN PLACE

For the particular comfort of the driver, an auto robe is provided with steel clips for both the waist and ankles. The spring fits snugly around the waist, keeping the robe from slipping or falling from the driver's lap, and the ankle clips keep it from becoming tangled with the pedals of the car.

Auto Robe Provided with Steel Clips for Waist and Ankles, to Hold It in Place

HIGH-PRESSURE STEAM ENGINE HALVES FUEL COST

Differing radically both in appearance and performance from the ordinary engine, a super-pressure steam locomotive recently was demonstrated in Germany. The engine develops 2,500 horsepower, and uses a steam pressure of 120 atmospheres at a temperature of 500 degrees centigrade. Through its high-pressure steam system, the locomotive saves about forty-five per cent in heating material as compared with the ordinary type of engine. In appearance the locomotive is higher than the ordinary engine and its more powerful boiler has a greater streamlined effect than is usually evident. Aside from the economical aspect, the fuel saving of this super-pressure locomotive is important because such an engine, on a given supply of fuel, is able to make a longer trip without a stop than is the case with the conventional type of engine.

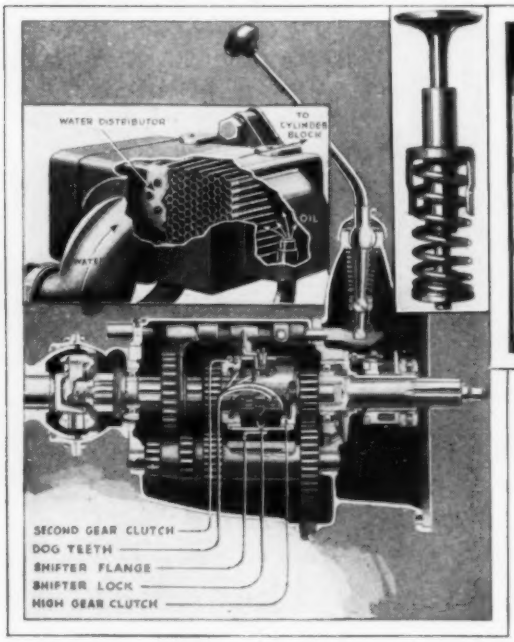


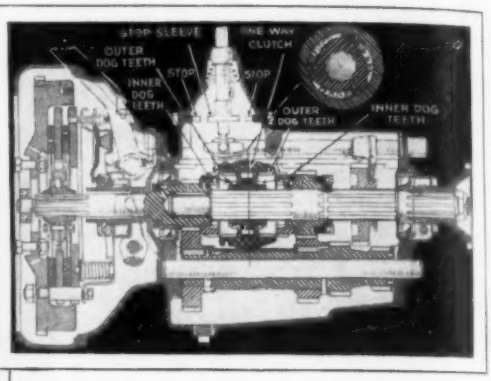
Two Views of the Super-Pressure Locomotive Developed in Germany; It Has 2,500 Horsepower and Saves Forty-Five Per Cent in Fuel

CARRIER PIGEONS ON AIRPLANE FOR AID IN EMERGENCY

Although the plan has not been entirely successful, homing pigeons are being used by the Royal Canadian air forces on forestry patrol to summon help when a ship meets with a mishap. If, for instance, a pilot is forced down, he releases one of the birds which is expected to return to the home airport to summon aid. One bird, sent on such a mission, returned to the base, but had lost its message on the way. The pilot who sent it returned after three days of travel. Birds released more than 500 miles from home ran into an electrical storm and only one out of eighty finally completed the flight. However, the work is carried on in the expectation that eventually they may prove a valuable part of a pilot's safety equipment.

LATEST AUTO IMPROVEMENTS GIVE MORE COMFORT





Recent Auto Improvements Include, Upper Left, Oil-Temperature Regulator; Center, Valve-Spring Cups; Below, Synchro-Mesh; Above, Free Wheel

After more than twenty-five years of intensive development, it hardly seems possible that anything of importance could be added to the automobile. Nevertheless, there are some unusual new features on the new model cars recently announced. Heading the list of innovations is a coasting device called a free wheel, adopted by one of the leading companies. Whenever the throttle is closed, the engine idles and the car coasts. Fuel economy is improved twelve to twenty-five per cent, depending on driving conditions and, particularly, on how hilly and winding the roads are. Wear and tear on the complete driving mechanism is proportionately reduced. But most important of all, the free wheel enables gear-shifting to high or second without touching the clutch pedal, and yet the shift is absolutely silent whether the lever is manipulated by novice or expert. So that the engine may be used as a brake in descending a long mountain grade, the free wheel may be "locked out" either in high or second, by depressing a button on the top of the gear-shift lever. Another outstanding device on the same make of car is an intake silencer. In plain language it is a muffler applied to the carburetor, not only to eliminate carburetor noises but more particularly to silence that annoying "power roar" which is heard on open throttle. Silent engagement of high speed and second gear under all circumstances is secured by another manufacturer by the adoption of what is known as a synchro-mesh transmission. Gear-shifting is silent regardless of how unskillfully the shift is made, or how slow or fast the lever is moved, and regardless of the speed of the car. Silent engagement is gained by means of two frictional metal cones, one for each gear, which bring the teeth to the same speed just an instant before they actually mesh. The same manufacturer has introduced another innovation, an oil-temperature regulator which cools the oil in summer and warms it in winter.

Another improvement is the extra spring shackle recently adopted by a large producer. Shackles of this type are also used by other manufacturers. The shackle is attached to the front end of the left front spring, and it is kept in neutral or normal position by four coil springs. Both front springs, of course, are shackled at the rear as usual. This device not only yields to absorb road shocks which would otherwise be transmitted to the steering wheel but also prevents shimmying. Valve springs and piston rings are also subject to shimmy—as well as front wheels, crankshaft and intake gases. When a valve spring shimmies, ripples or waves run up and down its coils, often overstressing them to the point of breakage. The shim-

my also reduces the effectiveness of the spring with the result that the valves do not close properly and "valve bounce" results. There are various remedies including the use of two concentric valve springs, a single conical spring or a frictional cup in contact with one end of the spring. Piston rings also are subject to shimmy. In fact, they may shimmy so violently at some certain speed, say, 3,200 revolutions per minute, as to cause a marked reduction in power. In the case of one new model, shimmy-proof piston rings, developed after long research, resulted in an increase of six horsepower at 3,200. This new ring is ground slightly oval, so that, in the round cylinder, its pressure against the wall is highest at the ring tips and diminishes gradually from this point. This slight variation in tension prevents shimmy.

RACK FOR CHILDREN'S CLOTHES DEVELOPS NEATNESS

To develop the habit of neatness, a metal rack for children's clothes is intended for the child's room, playroom or nursery. It consists of a metal base in which shoes, stockings and other apparel may be placed, and an upright frame on which garments may be hung. It can be obtained in different colors.

Metal Clothes Rack for Children Which Is an Aid in Developing Habits of Neatness

High-School Boy and His Violin Which He Made by Gluing Together 2,500 Safety Matches

VIOLIN MADE OF MATCH STICKS WORK OF HIGH-SCHOOL BOY

More than 2,500 safety matches of the ordinary variety were used by a Washington high-school boy in making a full-size violin which is complete in every detail. He spent six weeks constructing and gluing together his musical instrument. When finished, it was found to have a good tone.

SHIP CUT IN THREE SECTIONS TO MAKE IT LONGER

Unusual speed was made recently in rebuilding a 12,000-ton oil tanker in a British shipyard. The vessel was cut in three sections and a midship section 300 feet long and containing 4,000 tons of steel was floated in and joined up in seven weeks. Under ordinary methods, the work would have required at least four months.

¶The Popular Mechanics' Bureau of Information offers its free service to all readers of our magazine. Names and addresses of manufacturers and dealers in articles described, will be promptly furnished by the bureau.

The Lamps of the

One Type of Photo-Electric Cell, Used in Sun-Illumination Studies by the United States Public Health Service

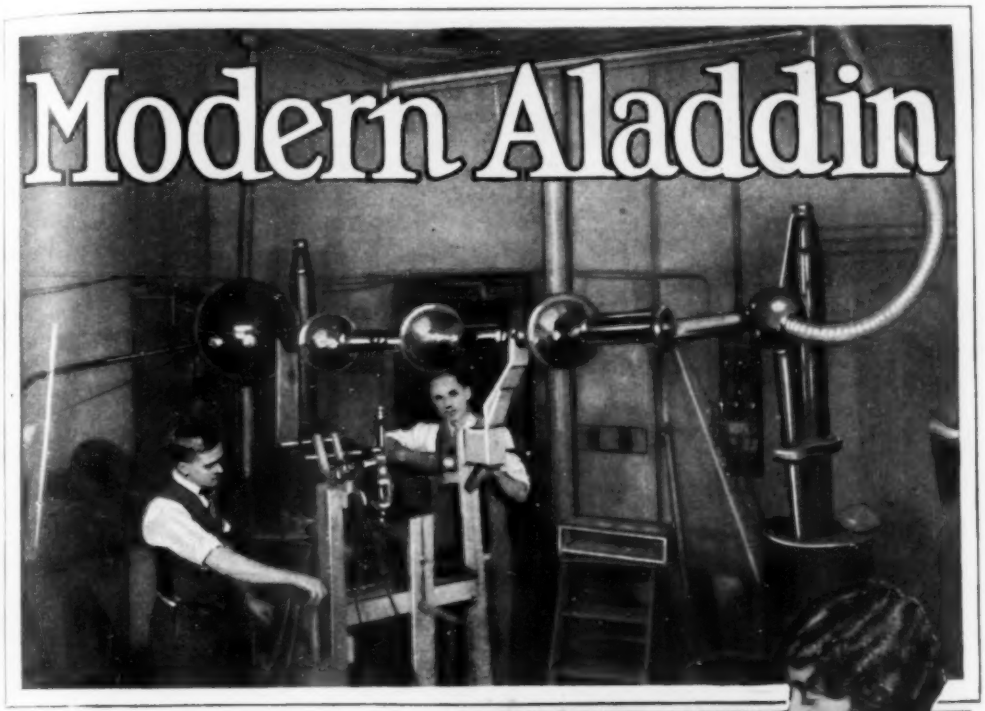
WHEN the front page of a San Francisco newspaper is read in New York shortly after it is printed; when a popular lecturer makes a ray of light produce music and transmit his voice across the room; when Australia chats with America, and engineers talk of bringing water power from Pacific slopes to industrial markets in the northeast—even this ultra-modern world begins to inquire, "Wherefore?" And the answer has more than a touch of the mysterious, for it is: "It's the vacuum—it's all in the vacuum!"

In the vacuum! But can there be anything whatever in a vacuum—defined as mere empty space, devoid even of air? Emphatically, yes! Truth, in the twentieth century, is more than ever stranger than fiction, for this is truth; and the man who first uttered the paradoxical statement, "The vacuum—there's something in it"—Dr. Willis R. Whitney, director of the research laboratory of the General Electric company—conducts an institution which is engaged in nothing else but making truth stranger than fiction.

Little unobtrusive glass tubes, each inclosing one of these curious areas of "nothing-something," now measure the heat and light of far distant stars; sort, grade and count quantities of small articles; safeguard premises from burglary and fire; turn on lights when darkness approaches; operate train signals, control electric motors and actuate compasses for ships and airplanes. Man has succeeded in utilizing the vacuum for transmitting entertainment programs great distances through space without connecting wires, for sending his messages to isolated spots, for aiding materially in alleviating his physical ailments. Every time he even switches on electric lights in his home, he relies implicitly upon vacuum, and millions of cubic feet of such light-giving "emptiness" are in nightly use throughout the world.

Otto von Guericke, burgomaster of Magdeburg, was a pioneer in electrical science. His accomplishments included the invention of an air pump with which he obtained a partial vacuum—not a high vacuum, such as is common today, but still one in which the air content was pretty thin. One day, in 1654, he called by appointment on Emperor Ferdinand III, accompanied by two teams of eight horses each, with their drivers and various queer paraphernalia. He showed the emperor two copper bowls which, when

Modern Aladdin

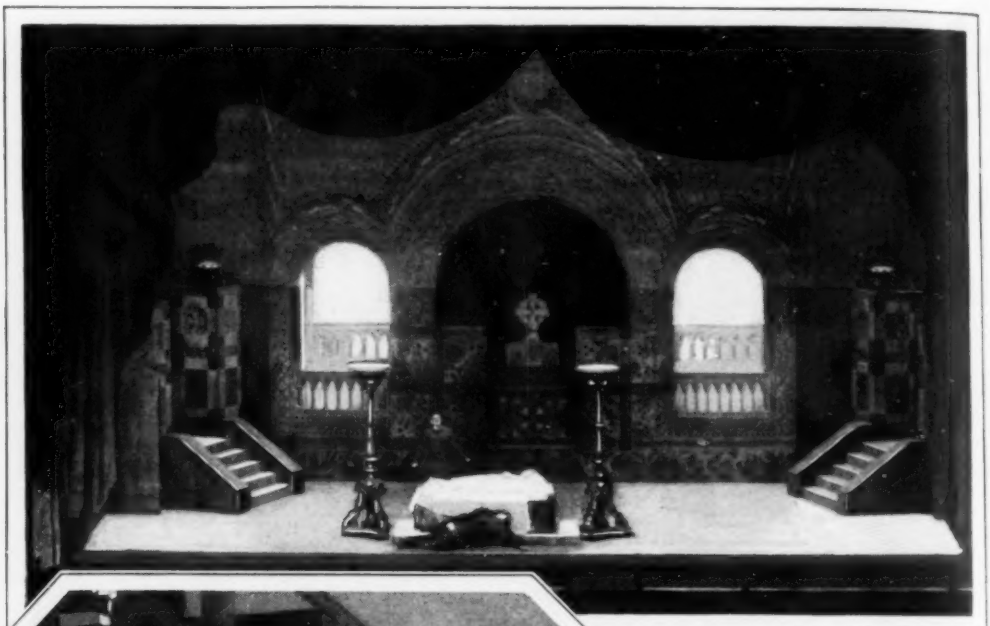


placed together, formed a hollow sphere. Between them von Guericke inserted a ring of leather soaked in wax and oil, making an air-tight joint, but there was no mechanical connection whatever. With his air pump he drew off a great deal of the air from the sphere through a hole which was closed by a tap.

The teams of horses were then brought up, one being hitched to each of the copper bowls or hemispheres. At the signal to go, the sixteen horses pulled and strained but their utmost exertions could not drag the hemispheres apart. The emperor, amazed, found it impossible to believe that the bowls were locked together merely by the difference in pressure between the atmosphere outside and the partial vacuum within.

Three-Section High-Voltage Cathode Tube, and, Below, Placing Rough Sapphires under Cathode Rays for Test

This was the vacuum doing tricks. The vacuum universally at work did not come until two centuries later, and Edison was the scientific "magician" of this later affair. By that time men knew much more about electricity, and there is a close working relation between electricity and the vacuum. Edison hit on a relatively minor aspect of it when he placed a hairlike carbon filament within a vacuum and then connected the filament to an electrical circuit. The resistance of the filament to the passage of the electric current made it glow with light, while the vacuum pre-



Scene from "Love of Three Kings," and Thyratron Rack for Chicago Civic Opera Installed Eleven Floors above Stage

vented it from burning up—and lo! the incandescent electric lamp was born, essentially a vacuum device.

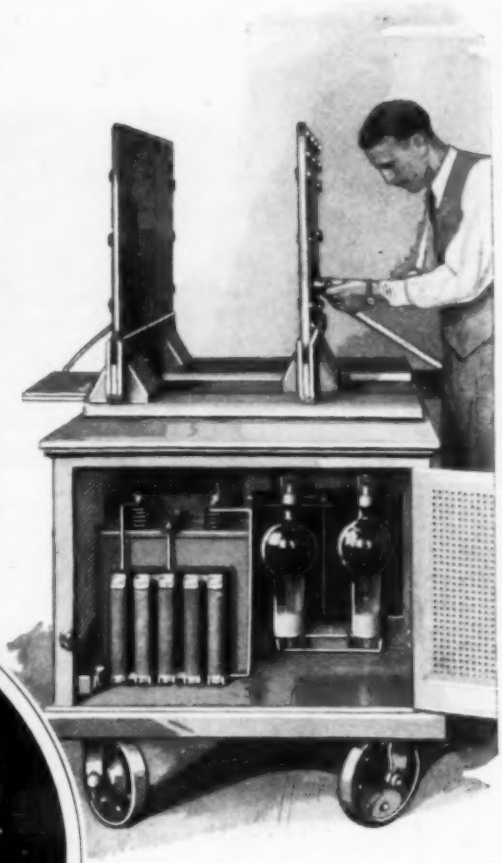
Had Sir Walter Scott seen this he might have paraphrased his own incredulous comment on the experiments of William Murdock, the pioneer of gas lighting. When he heard of Murdock's work he exclaimed: "There is a mad man who proposes to light London with—what do you think?—smoke!" If he had known of Edison's lamp, he would probably have scoffed: "There is a mad man who expects to illuminate the world with—what do you suppose?—nothing! A vacuum!"

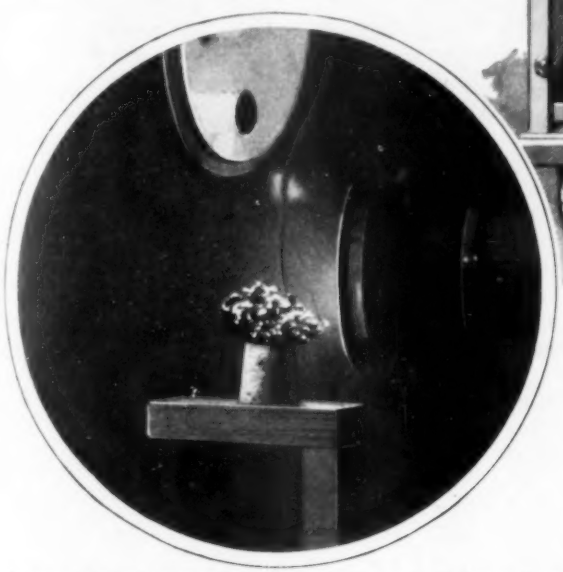
As it was, Edison's idea of an electric lamp was considerably ridiculed at the time. Among other criticisms, doubts were heard of the possibility of producing with facility such a high vacuum as was necessary. Sir William Crookes, the English scientist, who was then studying the subject, was asked if a vacuum as high as Edison required could be created in quantity. He replied, promptly and succinctly,

"Why, such vacua can be produced by the ton!" And so they have been, ever since.

Edison, as fate would have it, did more than construct a practical and popular electric lamp depending on a vacuum. He was the first to observe a peculiar electric current originating with the hot filament inside the vacuum and known at the time as the Edison effect. It was thirty years before scientists, working principally with Crookes' tubes, fully understood what this meant—that a hot filament in a vacuum gives off a stream of electrons (an electric current, but not usually a powerful one) capable of being manipulated in many remarkable ways.

In the successive brilliant discoveries that occurred in this great field, Millikan, J. J. Thomson, Fleming, DeForest, Langmuir—all of them laboratory experimenters of the great line—participated. This



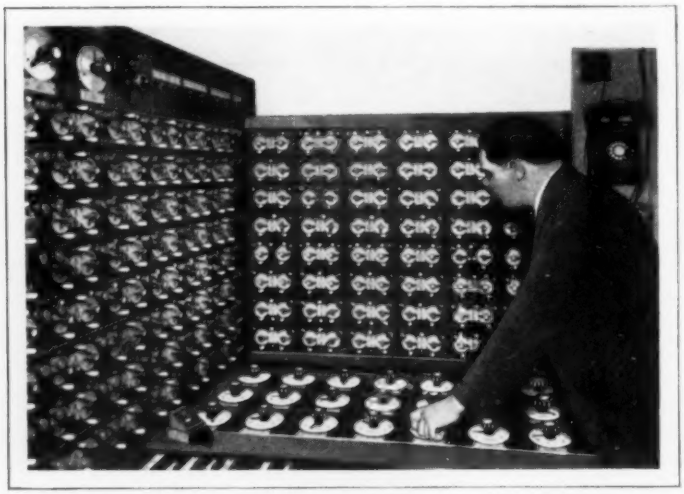


General Electric High-Frequency Heater with Rectifier End Open, and Precious Stone under Cathode Rays

work culminated at length in the modern vacuum tube with its boundless possibilities, already numerous and by no means even approaching finality. Radio broadcasting, one of the most spectacular and best understood of modern feats with vacua, was one of the earliest, following that of radio telegraphy.

Great numbers of these modern tubes are at present in world-wide use, each with its vacuum, and each vacuum more nearly perfect than ever before produced by man. So completely are these tubes and bulbs "exhausted" (that is, evacuated of air) that out of every seven hundred million molecules originally in each tube only one remains. Yet in every cubic inch of space in each tube there are still to be found, after the pumps have done their best, more molecules than there are people in the world! Thus it is far from empty, although a living creature in such an inclosure would instantly suffocate, if he did not literally explode before he was smothered.

The latest magician in the ever-growing family of tubes is the thyratron. In its common form it resembles the ordinary tube. However, it is not a vacuum tube, for it contains either a small quantity of a chemically inert gas at a known pres-



Part of Stage-Lighting Control Board, Used in Chicago Civic Opera House; It Is beneath and in Front of Stage

sure, or a drop of mercury which produces a low pressure of mercury vapor in the open space.

The currents which can be controlled by thyratrons are immense compared with those of high-vacuum tubes under similar conditions. The new tube also has the advantage of fineness of control, absence of wear, and silence.

The first use of the thyratron outside a laboratory was in the stage-lighting equipment of the new Chicago Opera House. This institution undoubtedly has the most advanced system of theater lighting found anywhere in the world. Henceforth, a "lighting director" will control the illumination of a large auditorium, not an electrician. Instead of throwing his weight on those immense switches commonly found backstage, he merely moves a dial with the turn of a wrist. One of these dials can do the work of ten ordinary switches.

At the Museum of Peaceful Arts in New York, I was startled on entering. I came off the elevator and made a step forward, when from some mysterious corner came a voice saying, "Thank you!"

For what? I turned about. Not a man in sight. I asked an attendant who had thanked me, and he answered, "Meet Mr. Thyratron, the robot greeter."

Well, the thyratron cast in the role of a greeter. It turned out that I had interrupted a light beam in stepping off the elevator. The eagle eye of a photo-electric cell caught the shadow. It told the thyratron tube, which turned on a phonograph record, which said politely, "Thank you."

Again, at the House of Magic in Schenectady, I was shown a heavily bolted door, and asked, "Can you open that?" I shook my head, "Not without the proper keys." My guide waved his hand as a hypnotizer would do before his subject. Lo! the door was hypnotized, for it swung open. "You see," explained the guide, "the thyratron makes homes safe. You can't forget your key. The combination to this door is the way in which you wave your hand. If you forget how to do that, you'll be locked out of your own home."

Now just inside the magic door is a sign asking the visitor to say "hello" into a telephone mouthpiece. I did. This set into operation another thyratron which started a phonograph to playing an orchestral composition.

Among other recent applications of electron tubes is a fire-prevention system. By placing photo-electric cells around an industrial plant, it is possible to detect the first puff of smoke and have an alarm turned in automatically.

The light cell has also been found useful in automatically bringing elevators to a level stop. In the paper industry, photo cells are now used to determine the correct proportion of wood fiber in raw pulp.

In short, the electron tube has such universal applications that, without it, civilization would surely stagnate. So far as we know, television would be impossible; likewise, talking moving pictures and long-distance telephony. Were electron tubes suddenly prohibited by law, every major industry in the world would suffer a collapse. But the end is not yet. The most conservative scientists foresee such a tube development that everything one hears, sees or buys will be controlled in some important aspect by tubes.

"COMET" AIRPLANE IS BUILT LIKE GIANT BOX KITE

Resembling a barrel with both ends open, a virtually wingless airplane of radical design is undergoing tests in New Jersey. It is called a comet plane and is a monocoupe with a sixty-horsepower motor and a four-bladed propeller beneath its wire-incased prow. It works on the air-tunnel principle of the box kite, the rush of air through the barrel-like fuselage causing it to rise, just as the rush of air through the tunnel of a box kite causes it to ascend. Once in the air, the ship depends on a set of stubby ailerons, on the forward end, and elevators in the tail to steer it. It is furnished with an unusually large airplane-type rudder. The craft can take off from land or water, and because of its lack of wings, can be stored in an ordinary garage or taxied along a highway. The inventor, a former German army flyer, claims it will travel at 300 miles an hour, and plans a trip in it from New York to Berlin in twelve hours.

Side, Front and Rear Views of a Virtually Wingless Airplane of Radical Design; It Resembles a Barrel with Open Ends and Operates on the Principle of the Box Kite

UNSEEN FENCE ACROSS PACIFIC IS BARRIER TO SEA LIFE

Stretching east and west across the Pacific is an invisible fence of water without oxygen which forms an effective barrier to sea life. This belt of water without oxygen has been found to begin 300 feet below the surface, to extend downward 1,000 feet and to be 100 miles wide. Since all creatures of the sea require oxygen, this stretch of water, which constitutes a phenomenon as yet unexplained, forms a fence separating the northern sea life from that on the south. The discovery was made during a scientific expedition by the nonmagnetic ship "Carnegie," later destroyed by fire at Samoa.

SPONGES TANNED LIKE LEATHER

Sponges now are being tanned like leather, and for a similar purpose, to increase their strength and resistance to decay. The tanned sponges are intended primarily for laboratory and industrial uses, while those employed about the home are not so treated.

Hand-Carved Wooden Model of Cleveland Union Terminal; It Contains 50,000 Pieces of Wood

HAND-CARVED MODEL TAKES TWO YEARS TO FINISH

Working five hours a day for two and one-half years, a Cleveland barber has completed a hand-carved wooden model of the $160,000,000 union terminal tower in that city. It is composed of 50,000 pieces of wood, all carefully glued together, and is an exact duplicate from the street lamps at the bottom to the flagpole at the top. More than 3,000 illuminated windows are contained in the structure. Having no plans to work from, the barber made more than 100 trips to the building itself to obtain his ideas.

LITHIA WATER SERVED FREE AT PUBLIC FOUNTAINS

Carbonated mineral water flows from drinking fountains in Ashland, Ore., where the water is served free to the public after passing through an electric refrigerating process. It comes from natural mineral springs, and the gas from the springs is used to operate the town's fire whistle, and also as free air in some garages.

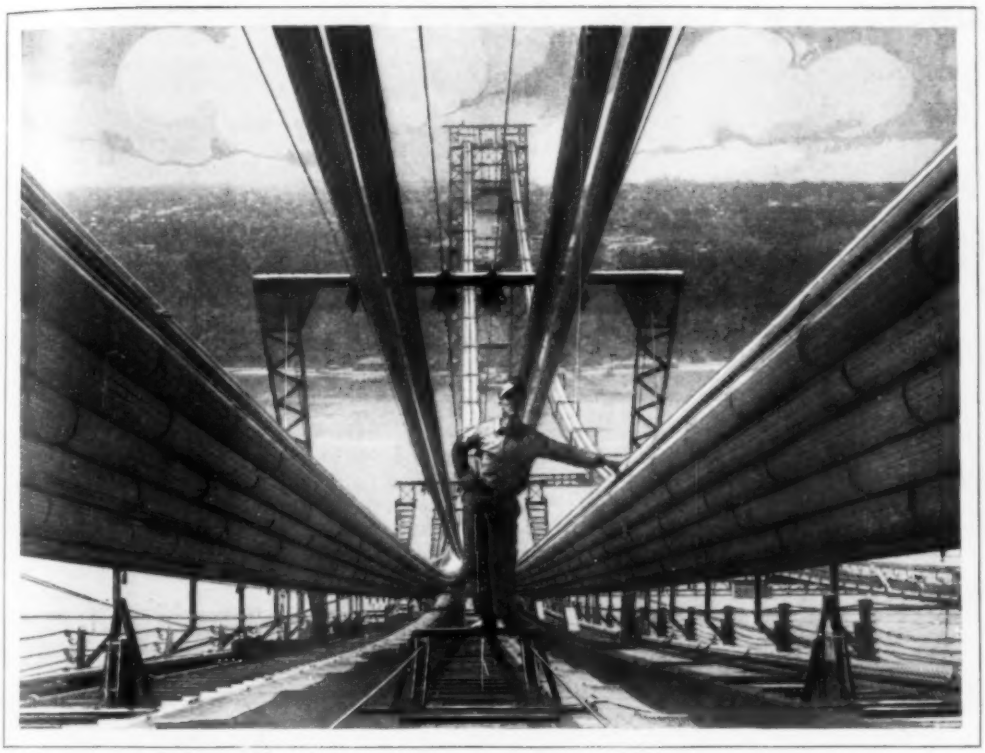
RUBBER PLATING OF CONCRETE WOOD AND METALS

Rubber plating of wood, metals and concrete is being attempted to encourage the vending of perishable goods by automatic coin-operated machines. By a process recently developed, such materials can be coated with a film of rubber, thus eliminating one of the difficulties in vending dairy products. Heretofore the sweating of the packages caused them to freeze to the metal parts of the vending machine, but the rubber plating obviates this difficulty. The rubber plating also is expected to facilitate the use of dry ice.

AUTOMATIC CARD TABLE FOLDS ALL LEGS AT ONCE

All the legs of an automatic card table may be opened or folded simultaneously in one operation. One leg is folded in the usual manner, this action manipulating a folding device beneath the table top which also causes all the other legs to collapse. The folding mechanism is simple and positive in action, there being no complicated parts to get out of order.

All the Legs of This Card Table Are Opened or Folded Simultaneously in One Operation



Two of the Great Cables That Will Support the Hudson River Bridge at New York, the World's Longest Suspension Span; More Than 107,000 Miles of Wire Are Spun into These Cables

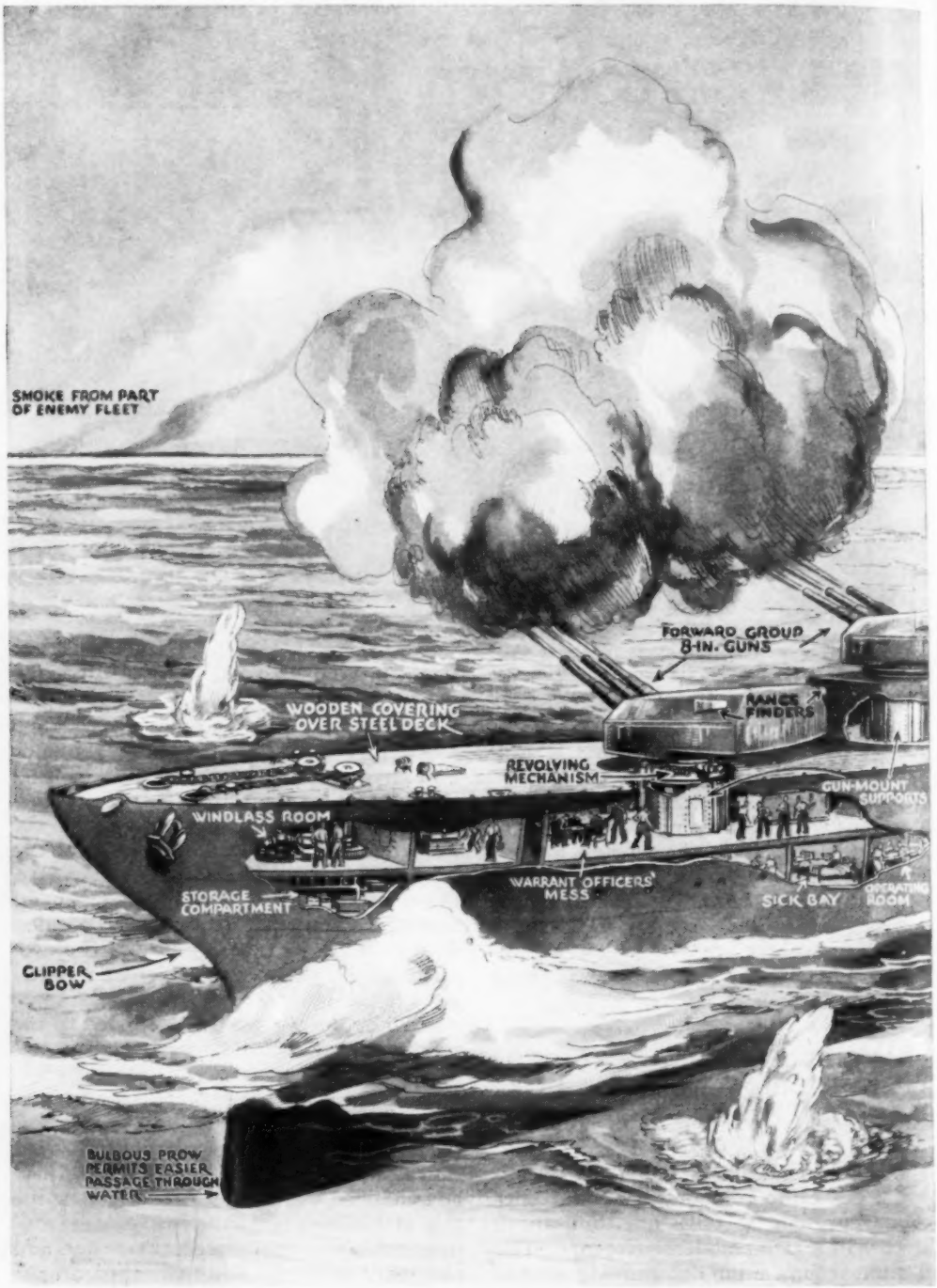
MANY MILES OF WIRE CARRY WEIGHT OF BRIDGE

Gigantic wire cables will support the enormous weight of the new Hudson river bridge at New York, the world's longest suspension span. About 107,000 miles of wire will go into the cables, spanning 3,500 feet of space. The 26,000 wires of each of the four cables are grouped into bundles of 434 wires each, the bundles being known as strands.

SEARCH FOR NEW STARS AIDED BY MIRROR TELESCOPE

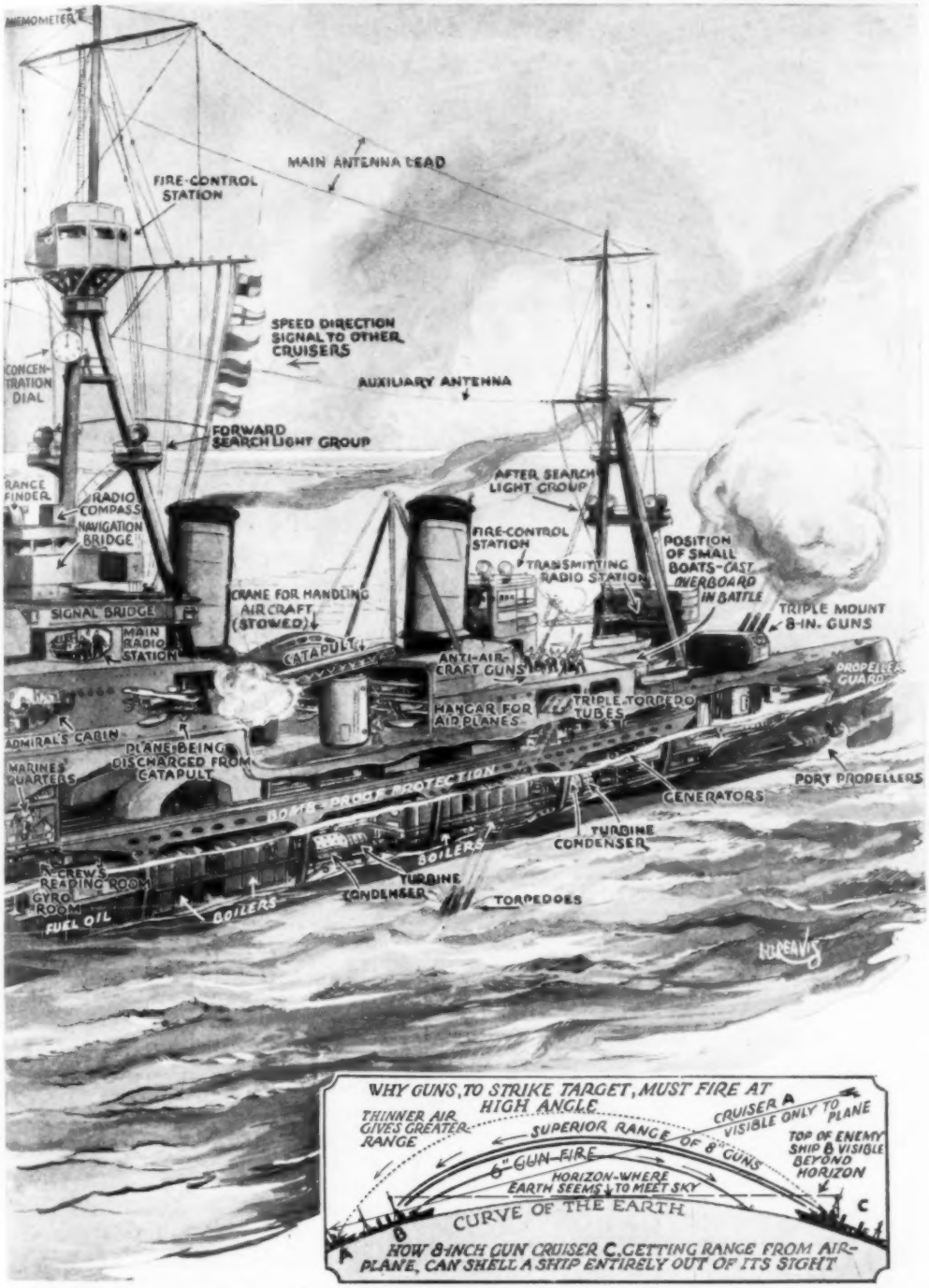
For bringing new invisible stars into the field of observation, Prof. C. W. Woodworth, of the University of California, has made a composite mirror telescope representing only one-thousandth the cost of a large modern telescope. The instrument may aid in determining whether there is a possible limit to the number of stars in the universe. It has for its underlying principle the bringing of many rays together and focusing these upon a single spot for magnification. To such an extent can the process be carried, that the light from an ordinary star of no great magnitude can be made unbearable to the human eye. Four hundred mirrors are contained in a frame about ten feet square, these mirrors being larger at the center and decreasing in size toward the sides. Every mirror surface represents the segment of a sphere, and they are ground so that the images of all will be the same size. The mirrors may be adjusted to the proper angles and are supported by a metal framework constructed so that its form is affected by changes in temperature. They all are focused on a single spot where the reflected light from a star is thrown. At the focal point this reflected light may be magnified and studied. To increase the size and efficiency of the instrument, it is only necessary to enlarge the frame and add more mirrors. With the apparatus it is possible to gain a reflected glimpse of stars that have never been visible through any telescope.

UNCLE SAM'S LATEST TREATY CRUISER IN "ACTION"

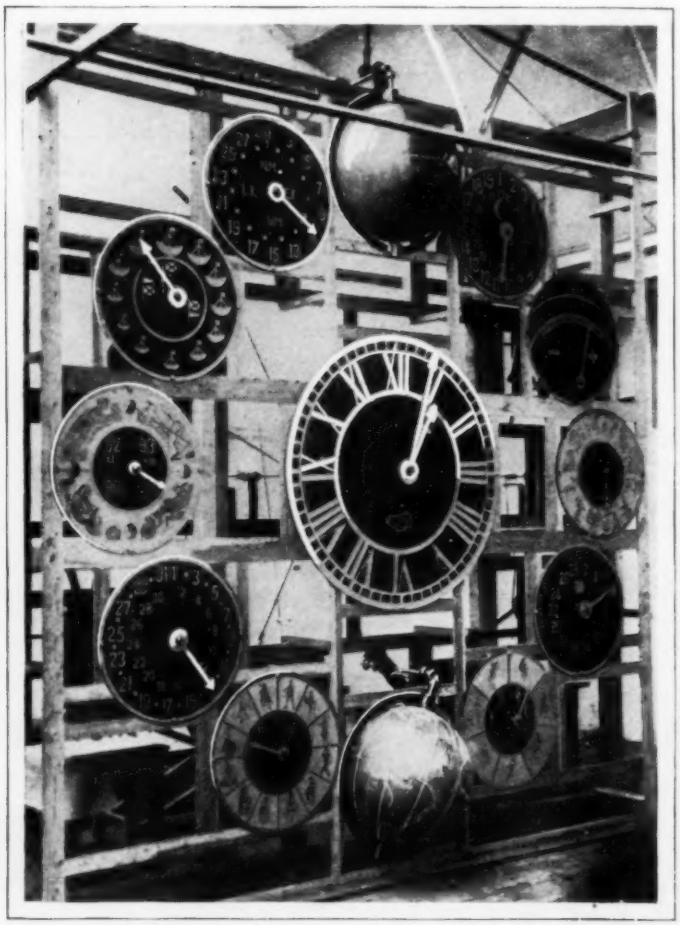


Artist's Drawing of Recently Completed Cruiser "Northampton," Showing Inner Details and How It Would Look in Battle; Note the Two Smokestacks Instead of the Usual Four

TEN-THOUSAND TON WARSHIP IS BUILT FOR SPEED



This Cruiser Develops in Excess of Thirty-Five Miles an Hour; It Is Longer and Has a Broader Beam than Other Ships of Its Type; the Diagram Explains the Effectiveness of Its Eight-Inch Guns



Super-Clock, Built in Belgium, Which Tells the Time of Day, and Gives Signs of Zodiac, the Solar System and Days of the Week

CLOCK KEEPS TAB ON UNIVERSE IN MEASURING TIME

One of the most intricate clocks in the world recently was unveiled in the old tower of Cornelius at Lierre, Belgium. Besides indicating the time from Greenwich, this super-clock virtually keeps track of the universe, giving the signs of the Zodiac, the solar system, days of the week, phases of the moon and the tides.

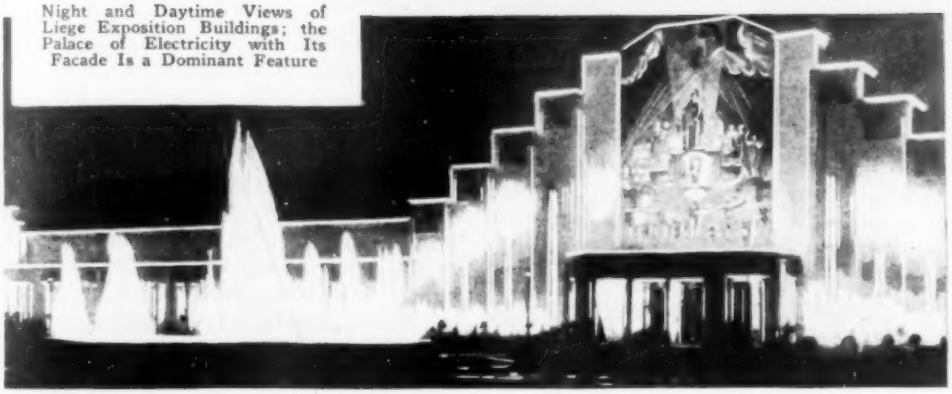
BEES GO THOUSANDS OF MILES FOR ONE POUND OF HONEY

One pound of honey sometimes represents about 300,000 miles of travel by the bees that produce it, tests by the department of agriculture indicate. The department learned that bees will often fly eight miles or more and return with their minute loads. Thus a pound of honey would represent approximately 18,000 trips of sixteen miles each. Hives were placed eight miles from the nearest nectar supply, and the bees made regular daily trips from the hives to the supply and back. Some of them, however, were impeded by sand storms or head winds. Laden with honey, they were forced to rest and sometimes reached the hives exhausted.

VARYING NAMES OF SAME WIND LEAD TO CONFUSION

Each country has its favorite names for its distinctive winds although fewer than a dozen different winds are recognized by meteorologists, and the many names applied to the same wind often lead to confusion. Blizzards are known as burans, poorgas or pamperos and the Central American chubasco season is a small-scale copy of India's monsoon, while an Australian in Texas would soon learn that a Texas norther corresponded to his own southern burster. America's hot wave from the south is a sirocco in Italy and a solano or leveche in Spain. Australia probably bestows more curious nicknames on its winds than any other country. There the north winds are brickfielders, hurricanes are willy-willies, a cooling breeze from the sea is the Fremantle doctor and Cockeyed Bob is a thunderstorm. The soft, dry, warm breeze that sweeps the Rockies in early spring is called a chinook by natives. The Swiss who sniffed it would call it a foehn wind, a South African a berg wind, a Sumatran a bohorok and a Faroe islander a glave wind.

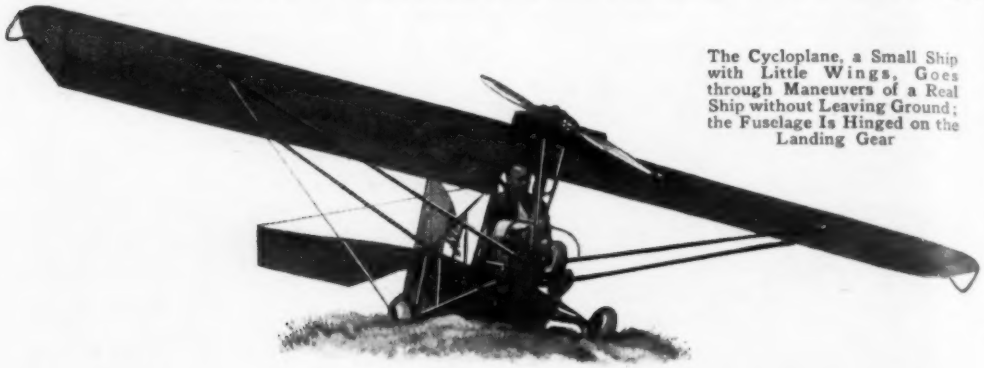
LIEGE FAIR REFLECTS LATEST BUILDING TRENDS



Night and Daytime Views of Liege Exposition Buildings; the Palace of Electricity with Its Facade Is a Dominant Feature

Modern Adaptation of Columns with Angular Designs on Capitals and "Step-Back" Towers

TRAINING IN CYCLOPLANE HELPS STUDENT FLYERS



The Cycloplane, a Small Ship with Little Wings, Goes through Maneuvers of a Real Ship without Leaving Ground; the Fuselage Is Hinged on the Landing Gear

Capable of performing most of the stunts of a real airplane in the air, although it does not leave the ground, the "cycloplane" is being employed to train student aviators. The ship is in reality a baby plane with a low-powered motor and wings of relatively small surface. The fuselage is cleverly hinged on the landing gear, and joints are so placed that the ship can bank or turn on the ground with the same effect as though it were in flight. An additional set of wings, with sufficient surface to take the student up, are attached after the ground work has been mastered.

HIGH-SPEED STREET SPRINKLER OPERATED BY ONE MAN

On the streets of Berlin a small sprinkler that is operated by one man is being used successfully in cleaning and flushing the pavement. In comparison with the heavy motor sprinklers, it is very speedy, and also has the advantage of being maneuvered easily, while the cost of operation is reduced by about forty per cent.

Small Street Sprinkler Operated by One Man

THUNDER CONVERTED TO MUSIC IN RADIO EXPERIMENTS

Musical thunder, accompanied by a vivid electrical display, was encountered by radio engineers recently in experiments with high-powered short-wave broadcasting. The thunder, created artificially, was converted into music corresponding to the input at the radio microphone. In handling powers above fifteen kilowatts on the short waves, the engineers found that vivid coronas flashed when attempts were made to modulate. Since the power supplying the arc was modulated with music, the arc alternately collapsed and built up according to the modulation, this action setting up air-wave vibrations similar to thunder. Instead of the roar and roll of real thunder, however, it was a musical sound similar to the music being broadcast, and persons 400 feet away thought they were hearing the output of a giant loud speaker. The arc finally melted the copper and caused the antenna to drop. The trouble was solved when larger antenna wire was used, and a large corona plate was placed at each end, making it possible to obtain thirty-five kilowatts, perfectly modulated in the antenna, without coronas.

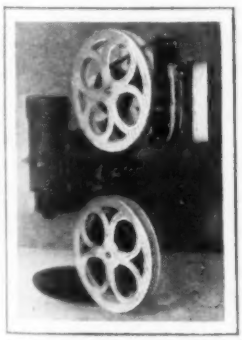
¶Whenever you find that you wish to know more about any article in this magazine, write our Bureau of Information.

LOSS OF AIRMEN IS BLAMED ON ORE DEPOSITS

Deposits of magnetic ore in the north Atlantic may possibly have caused the death of several transatlantic flyers in the opinion of Lieut. Col. Charles Kingsford-Smith, in charge of the flight of the "Southern Cross." He said that, in crossing from England to America, all three of his compasses failed to function when about 400 miles off Nova Scotia. Later he found that every other successful ocean flyer with whom he talked encountered similar difficulty at about the same place. He believes that there must be some extraordinary deposit of ore or other strong magnetic attraction in that section, and that the unsuccessful flyers lost their way there. The "Southern Cross" had radio equipment which served while the compasses were useless. Rear Admiral W. R. Gherardi, of the U. S. Navy hydrographic office, said there have been instances in which ship compasses have been deviated by magnetic influences from ore in shallower waters, but off Nova Scotia, where the water is two miles deep, such sources of disturbance woud be too far removed to affect the magnetic needle. In any case, a non-magnetic compass has been suggested for safety.

MOVIE-FILM CLEANER FITS ON THE PROJECTOR

Extremely simple and practical to operate, a motion-picture film cleaner can be connected with the projector and removes grease, oil spots and dirt as the film runs through the projection machine. It weighs less than a pound and consists of an upright frame, through which the film runs between two layers of tape moistened with a cleaning fluid. Under regulated pressure, the dirt and grease are wiped off, then, in passing through the projector mechanism, the film becomes dry before reaching the take-off reel.



Lunch Counter on Washington-New York Train Where Passengers May Eat at All Hours

RAILWAY-CAR LUNCH COUNTER FOR HUNGRY PASSENGERS

Railroad passengers who like to eat between meals now may have their wants satisfied on one of the fast trains between Washington and New York. A sandwich and lunch counter has been installed in one of the cars, which has as an added feature reclining chairs inducive to rest and comfort during the night journey.

MUSKOX HERDS FOR ALASKA

In an effort to replace the lost muskox herds of northern Alaska, the department of agriculture is importing thirty of these animals from Greenland. The little herd will be expensive, for it will cost $40,000 before it finally is established in its new home. However, it is expected the animals eventually may pay for themselves many times over, as the reindeer have done, by becoming the basis of a new meat-producing industry, utilizing food plants that now go to waste. Zoologically the muskox stands in the missing-link position between cattle and sheep. The imported herd will travel from Greenland to New York, then by rail to Seattle, and by boat and rail to Fairbanks.

The Fishermen's

Scene on Board the "Columbia" during a Trip to the Grand Banks; This Boat Was One of the Fastest Fishing Schooners Ever Built; She Was Lost during a Voyage Four Years Ago

By JOHN F. COGGSWELL

SIR THOMAS LIPTON'S "Shamrock V" and America's "Whirlwind," "Enterprise," "Weetamoe" and "Yankee"—they and their $5,000,000 yacht race for the America cup aren't causing even a riffle of excitement among the men of Gloucester, Mass., whence sail the fishing schooners to the Grand Banks. Nor among the fishing folks of Nova Scotia, either.

Any other year, these peerless sailors of the rough waters might find time to argue over the big sporting event. But just now they have a race of their own to worry over. For, after seven long years, the Gloucestermen have added to the fishing fleet a schooner, the "Gertrude L. Thebaud," that seems to have more than a chance to wrest the International Fishermen's Cup from the "Bluenose," the pride of the Canadian fleet, hailing from Lunenburg, Nova Scotia.

Furthermore, the fishermen of both Lunenburg and Gloucester have declared themselves eager for the contest, and all that remains is for the international committee to get together and arrange course and dates. The race will be off Halifax and the dates likely will fall late in October.

Until ten years ago, these fishermen's races were local affairs. The pick of the Gloucester fleet raced off their home town, and Canada's fastest fishing schooners met off Halifax. Each fleet found its champion, pulled off a big celebration in honor of ship and crew and then went back to their fishing.

In 1920, a Canadian editor—inspired doubtless by the fact that in that year Sir Thomas sent over the "Shamrock IV" to race the "Resolute"—promoted a race between the champion schooners of the two fleets. He put up a big cup—almost as ornate as the one that the America brought home from England in 1851—as emblematic of the speed championship of all the schooners that fished the Banks.

Immediately, the Nova Scotians sent down a challenge for the Gloucestermen to come up and take the cup if they could. The Bay State fishermen accepted with enthusiasm, and the race was on. The

Race

time was too short to hold elimination contests, so Gloucester picked the "Esperanto" and Capt. Marty Welsh and sent them to Halifax to race the "Delawana," of Lunenburg, best two out of three.

Cap'n Marty turned the trick. With light winds, he sailed his ship over the course and brought her home well in the lead to take the first race. The next day, with a full gale roaring out of the north, he repeated the performance, finishing so far in the lead, that there was no doubt of the superiority of the Yankee craft. So the cup came to Gloucester, in two straight races, but it stayed only one year at the New England fishing headquarters. During the winter of 1920-21, the Canadians built a new schooner. She was big—capable of carrying more sail than any schooner in the American fleet. In these fishermen's races, the bigger ship suffers no time penalty—the schooners race "boat for boat" regardless of size, sails or tonnage. They called the new ship "Bluenose," and on her trips to the Banks she proved as swift as they had hoped.

Gloucester stood pat on the "Esperanto." But during the summer of 1921, the swift little ship, homeward bound from the fishing grounds, piled up on a reef off Sable island. After elimination races, the Gloucestermen sent the "Elsie"—a little craft much smaller than the Canadian entry—into a race against the "Bluenose." She went down to defeat in two races, and the cup went back to its Canadian home.

The next year, the Yankees entered the "Henry Ford," a new ship from which they expected great performances, but she shared the "Elsie's" fate—the "Bluenose" chalked up two more victories. Then the Gloucestermen built a real ship, the "Columbia." She had everything but luck. In the elimination races off Gloucester, she sailed away from the best of the American fleet. Then she set out for another trip to the Banks before meeting

Above, Captain Clayton Morrissey Who May Command American Entry, and, Below, the Prize Cup

the "Bluenose," and was run down by a steam trawler. By heroic efforts, the crew kept her afloat while the trawler towed her to the island St. Pierre, off Newfoundland. Just one thing, they said, kept them from abandoning her—they knew she could beat the "Bluenose."

Repairs made at the island port, they sailed back to the Banks, caught a full cargo of fish and made for Gloucester, two men at the wheel in anything more than a light breeze on account of a split rudder post. There was just time to discharge the fish and make Halifax in time for the race—not time enough to repair the rudder post. So to Halifax, split post and all, she sailed.

The "Columbia" didn't lose. But her hard luck prevailed and prevented her from bringing home the cup. For the full forty sea miles (about forty-seven land miles) of the triangular course of the first race, it was nip and tuck; first one schooner and then the other nosed ahead, but never did either have any great advantage. But the "Bluenose" crossed the finish line fifty seconds ahead of the "Columbia"—compare that finish with any in the big yacht race.

Again, in the second race, the "Bluenose" breezed home one and a half minutes ahead of the "Columbia," but the race committee awarded the contest to the American ship as the Canadian had failed to round one of the buoys, which made the contest stand one race apiece, but the skipper and crew of the "Bluenose" decided they wouldn't sail the third, and deciding, race.

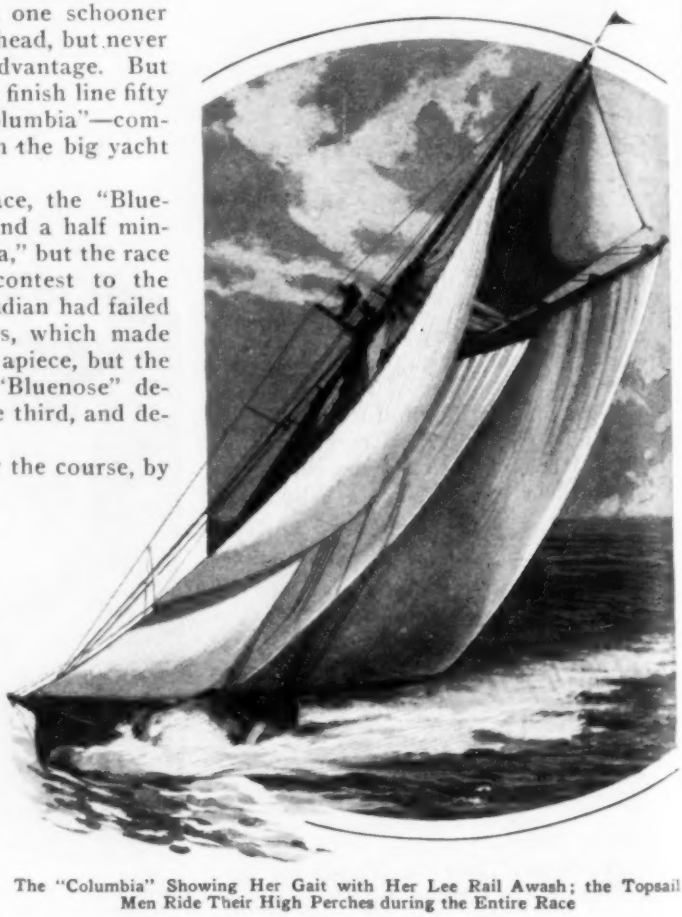
"Sail your schooner over the course, by herself, and take home the cup," the committee told Captain Pine.

"I came here to race the 'Bluenose' not to go for a sail," answered the Gloucesterman and sailed home without the prize.

During the next two years, conditions in the fishing industry were such that neither Canadians nor Yankees cared to take the time or go to the expense of holding a race. In the fall of 1926, the "Columbia" joined the ghostly legion of ships that have sailed out of Gloucester and never come back. Ship and crew vanished into the waters with never a trace save only a battered dory that came ashore on Sable island, hard by the spot where the "Esperanto" crashed to pieces.

Then there was the "Puritan." A noble ship and a fast one, built especially to bring the cup again to Gloucester, but she never came back from her second trip. Flying before a northeast gale, loaded deep with her catch, she, too, was piled up on a bar off that same Sable island that claimed the "Esperanto" and the "Columbia."

Still the list isn't finished. For the "Henry Ford," even now claimed by the fishermen to have been able to beat the "Bluenose" with anywhere near an even break, and the "Elizabeth Howard," that



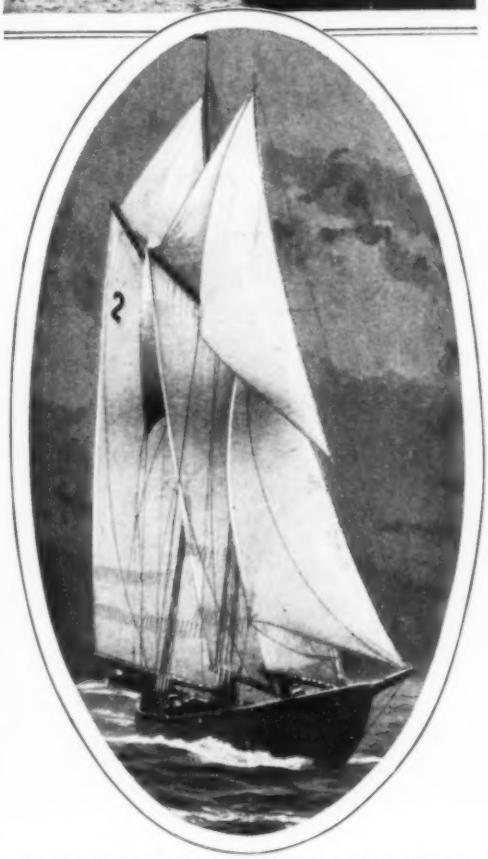
The "Columbia" Showing Her Gait with Her Lee Rail Awash; the Topsail Men Ride Their High Perches during the Entire Race

showed many a good ship and fast her stern, have both laid their bones on the ocean's floor. And even as this article is being written comes the news that the brave little "Progress"—that last year beat the best of the Gloucester fleet, even though a full twenty-five feet shorter than the smallest of her rivals—has burned and sunk at sea.

But the men of Gloucester are betting that the new schooner, the "Gertrude L. Thebaud," will outsail both the "Bluenose" and the jinx. For she is backed by Louis A. Thebaud, millionaire of Morristown, N. J., who has a summer residence near the fishing port, and Louis Thebaud is counted a harbinger of good fortune. Never has another fishing schooner just like the "Thebaud" sailed out of Gloucester. She was planned by Frank Paine, noted marine architect of Boston, who designed the America-cup defender, "Yankee." She cost nearly $80,000, the most money ever laid out for a New England fishing schooner.

Her every line denotes speed. She has the same long overhang that is noted in the yacht racers and her masts tower nearly as high as theirs, with mainmast of ninety feet and topmast of forty feet. Having two sticks, she will carry more canvas than any of the yachts. The latter have a waterline length of seventy-four to eighty-six feet and are 115 to 125 feet over-all. The "Thebaud" is 135 feet over-all and ninety-eight feet on waterline.

In the big race, the schooners are sel-



The "Gertrude L. Thebaud," New American Entry, on the Stocks; Below, The "Bluenose" and "Columbia" Racing Nearly Neck and Neck

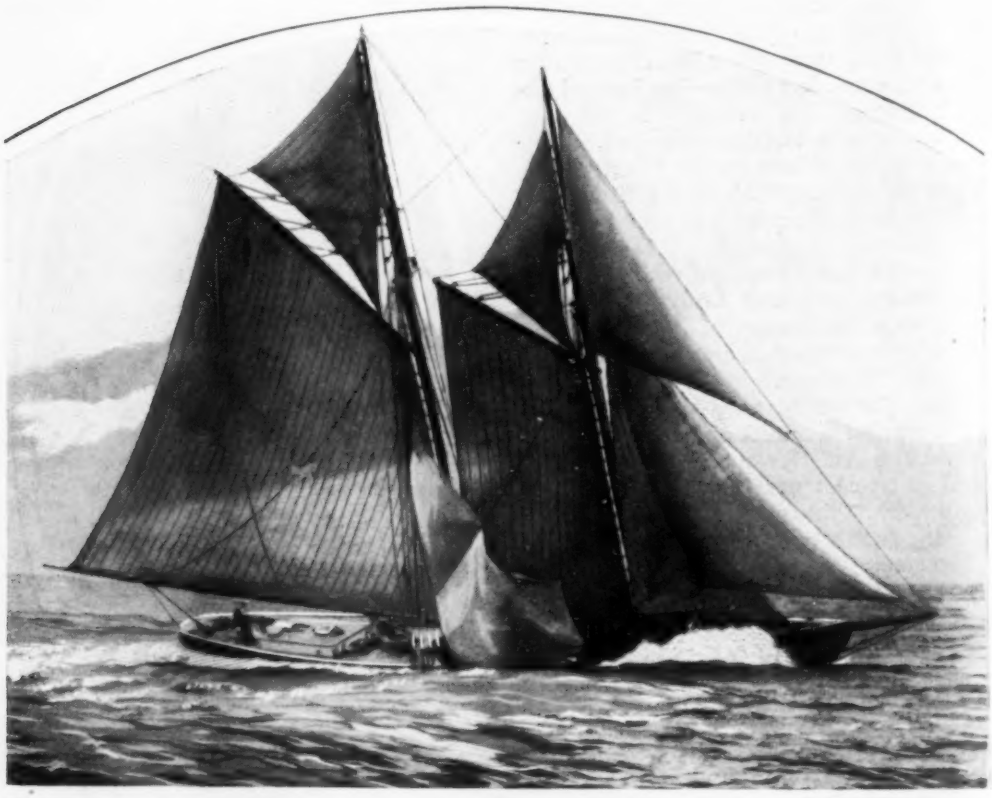
dom sailed by the captains and crews that man them on the fishing voyages. Every one aboard is a picked man, the best for his particular job among all the fishermen of the fleet. Capt. Angus Walters, a veritable sailing wizard, hard to beat under any conditions and a veteran of the Halifax course, will undoubtedly be at the wheel of the "Bluenose."

Gloucester has three skippers who are considered about on a par in handling a schooner in a race—Ben Pine, Marty Welsh and Clayton Morrissey. Long ago, all three of these became vessel owners in their own right and now spend most of their time ashore. But they're still rated the best in Gloucester, when it comes to getting all there is out of a fishing schooner in either a light breeze or a howling gale. Captain Pine, being a part owner of the "Gertrude Thebaud," will probably sail her in the international race.

The rules of the fishermen's race are few. Each contestant is allowed a crew of twenty-five men, including the captain, and two invited guests, one a pilot, if desired. A representative of the opposing schooner is also carried. There are no time allowances on account of a ship's length, tonnage or sail area.

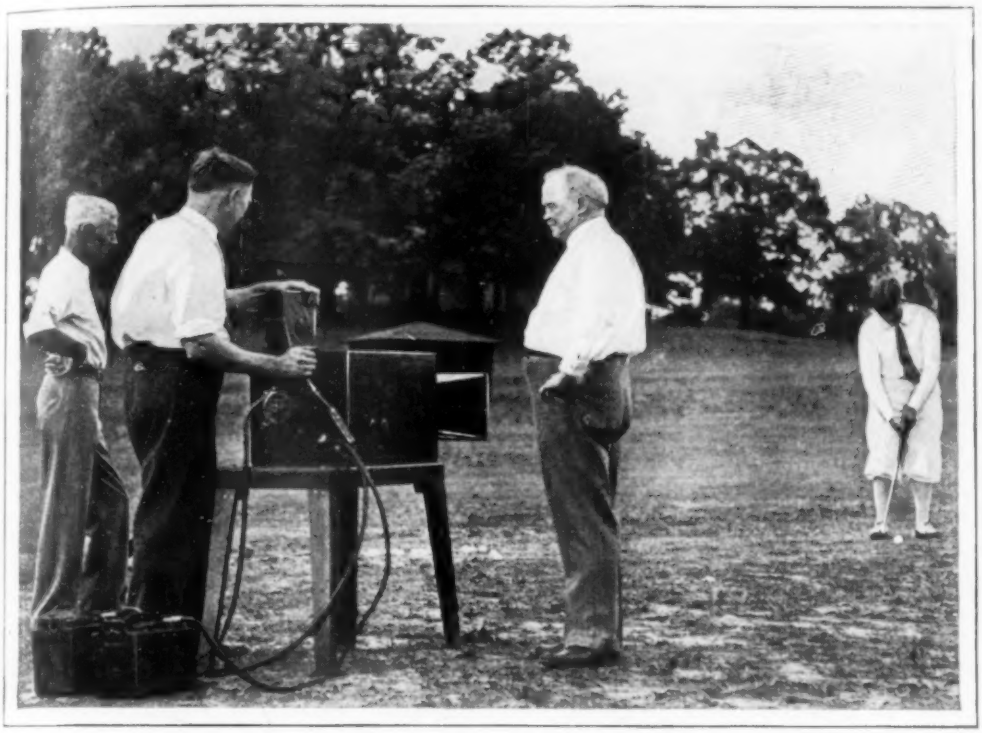
The approximately triangular course of forty sea miles—of course, on account of tacking, the boats sail much more than this distance—must be covered within nine hours, or it is no race. The competing schooners are allowed to carry only the number and size of sails ordinarily used in their fishing cruises, but the captains may use their own judgment regarding removal of part of the usual ballast.

The men of Gloucester believe that the "Thebaud" will beat the "Bluenose." But they are taking no chances. They are completing another schooner, as speedy, in case something should happen to the new contender.



Typical View of a Racing Fishing Schooner in Action; This Is the "Bluenose," the Canadian Vessel That Has Several Times Beaten American Boats and Will Compete in the Coming Race

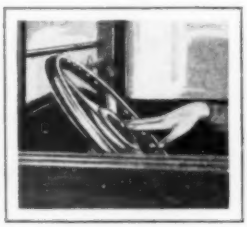
HIGHEST-SPEED MOVIE CAMERA HELPS TEACH GOLF



Using the Fastest Motion-Picture Camera to Improve the Golfer's Game; Pictures of the Play of Experts Are Taken with the High-Speed Camera to Show Every Motion of the Stroke

To acquaint golfers with the exact methods of play used by the top-notchers, pictures of the play of prize winners recently were taken with the world's fastest movie camera, for display throughout the country. The high-speed camera catches many of the fine points of the golfer's movements that would be missed by the ordinary camera.

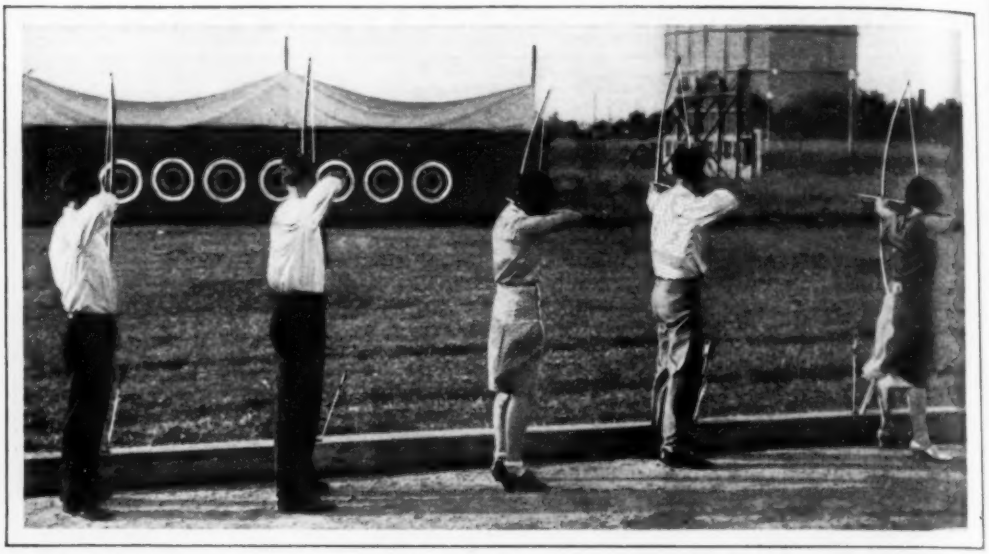
CAR STARTER, LIGHTS AND HORN OPERATED BY ONE BUTTON



One control switch, which operates the starting motor, the lights and the horn, now may be installed on any standard automobile. The finger-tip switch is a single button in the center of the steering wheel. Pressing down on the button sounds the horn, turning it operates parking, driving and bright lights, and pulling up on the button starts the motor.

BLIMP LANDS ON LINER'S DECK TO TAKE OFF PASSENGER

For the first time a non-rigid airship has landed and taken off from the deck of an ocean liner, the feat having been successfully performed recently when the "Mayflower," a blimp of the Goodyear fleet, came to momentary rest on the deck of the German liner "Bremen" as the ship reached New York. The airship paused long enough to pick up a passenger. An experienced ground crew was aboard the liner, on the deck of which a space eighty-five feet long and thirty-six feet wide had been cleared, the railings being lined with mattresses to prevent puncturing the gas bag. The "Mayflower" is 128 feet long and thirty-seven feet wide, so a slight miscalculation would have plunged the blimp into the ship's superstructure.



Small Archery Field Like the Miniature Golf Course; Several Targets on a Single Strip of Canvas Allow a Half Dozen or More Persons to Shoot at Bull's-Eyes Simultaneously

MINIATURE ARCHERY FIELD VIES WITH SMALL GOLF COURSE

Those who are tiring of the small golf course on a vacant lot now may take up archery on a similar scale. In Chicago, a miniature archery field has been constructed with several bull's-eyes on a single strip of canvas, thus allowing half a dozen or more persons to shoot at once.

AUTO IS BUILT FROM OLD PARTS OF A SCORE OF CARS

What might be termed a composite of most of the standard automobiles of the United States is contained in a car built by a Racine, Wis., youth, mostly from old parts. More than a score of different kinds of automobiles contributed to the composite machine, some of the parts being from models of fifteen years ago. Other parts are from current makes and a few are new or made specially for the composite automobile. For a few pieces, the maker went outside the automotive field, having obtained his door and rumble-seat hinges from an ice box. Assembling the auto required a year and a half of spare time. The hybrid car had its inception in an old 1919 chassis that the youth found abandoned on the lake beach.

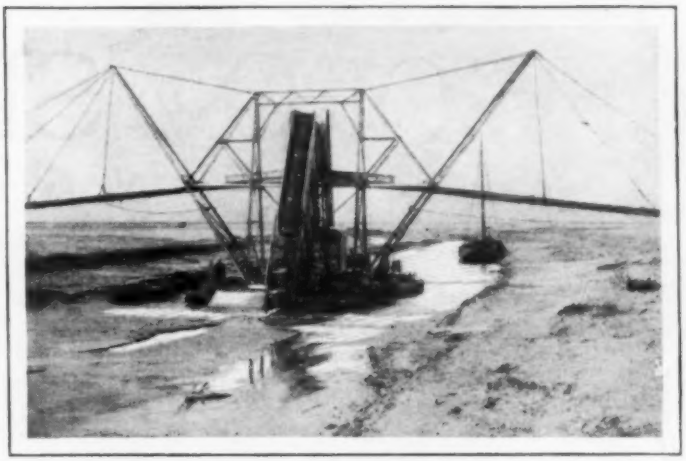
Auto Made of Old Parts of Twenty Cars

LEAVES IN LYE-SOLUTION BATH BECOME LIKE GAUZE

Certain kinds of leaves in Honduras are placed in a lye-solution bath to separate the veiny structure from the rest of the leaf, the result being a gauzy, silky coherent fabric used for making wreaths and corsage bouquets. The lemoncilla leaf lends itself best to this treatment. A half teaspoonful of lye is added to three quarts of water and the leaves are soaked for twenty-two days. They are then rinsed in clean water and dried. The gauzelike leaf can be dyed and can be stiffened by adding a starch preparation to the dye.

LOW-WATER MARK SET IN RIVERS BY DROUTH

Rivers which were breaking records for height a year or so ago set new marks for low water during the drouth of the past summer. All along the Mississippi river system, low records were established, readings being three and four feet, while the normal for the season is eleven or twelve feet. During the summer, many sections reported only a third or a fifth of the normal rainfall for the months, and in widespread sections the drouth was characterized as the worst ever recorded by local weather bureaus.



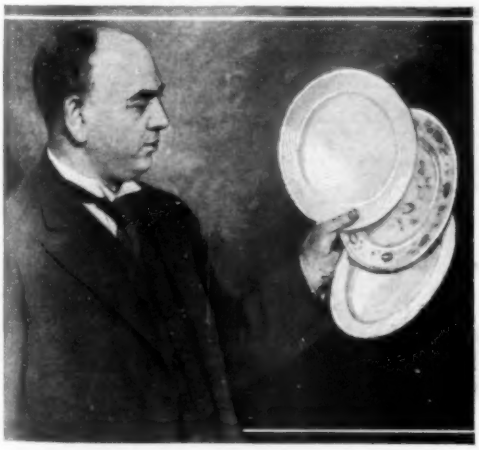
One of the Dredges at Work on the Bed of the Zuyder Zee; This Dutch Sea Is Being Drained to Provide More Farm Land

BED OF ZUYDER ZEE REVEALED AS PUMPS CLEAR WATER

Drainage of the Zuyder Zee in Holland, a project undertaken to convert the area into farmland, has progressed until the sea bed is visible. Two pumping stations were used, drawing off 4,000,000 tons of water a day from the historic Dutch sea, which has been completely diked in. There is an area of more than 45,000 acres lying just inside the island of Wieringen which is expected to be dry before winter. More than seventy-seven square miles of new land, most of it of the same rich, heavy clay as the adjacent province of North Holland, will then have been won back from the sea.

DISHES THAT WILL NOT BREAK MADE OF COTTON

After experimenting for several years, a British inventor has succeeded in treating cotton in such a way that it can be made into serviceable dinner plates and other light articles usually made of some material that is easily broken. Aside from being unbreakable when dropped, the cotton dishes and other articles also are light in weight as compared with the materials used ordinarily for such purposes.



Samples of Lightweight Unbreakable Plates, Which Have Been Made Entirely from Cotton

OIL DRIVING STEAM FROM SEA

Oil is gradually driving steam from the sea, according to shipping reports. In Great Britain, the tonnage of motorships now building is 831,159 tons, compared with 556,804 tons of steamships, while elsewhere the motorship tonnage is ninety-four per cent greater than steamship tonnage under construction. There are now being built in the world ninety-one motorships over 8,000 tons, but only thirty steamers, including ten motorships and eleven steamers, 15,000 tons and upward.

¶A fireproof cargo pouch of asbestos for air express and mail recently underwent successful tests.

I SOLO *in* SEVEN

By PAUL D. PADDOCK

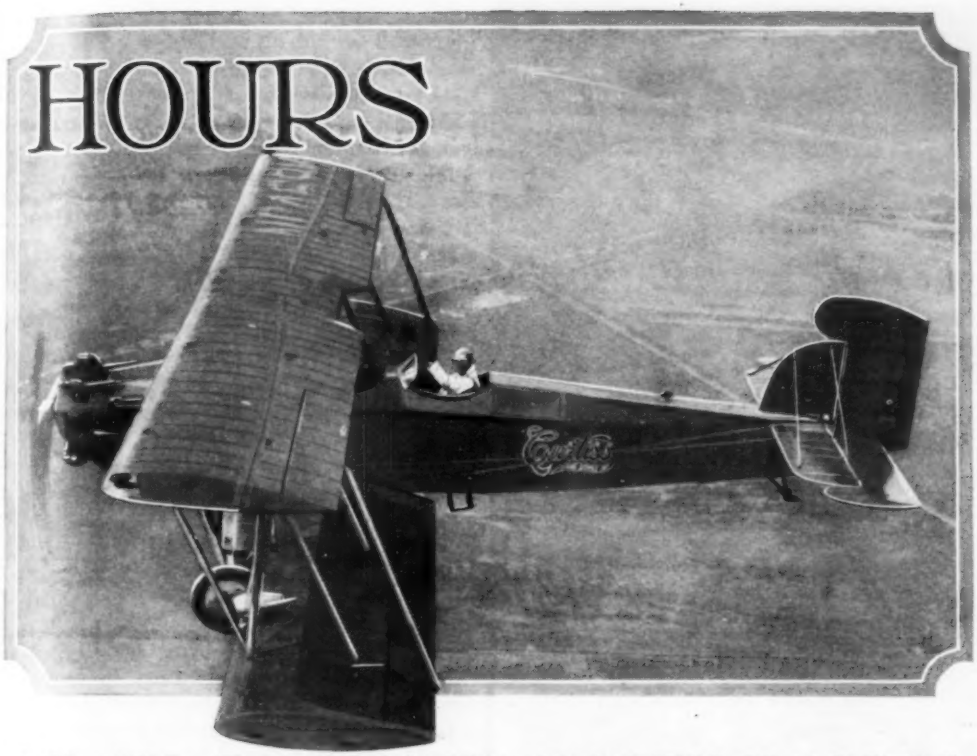
OUR altimeter needle was trembling around the 2,500-foot mark. The air was growing cool, and quiet too, as we were high above the disturbed currents nearer the ground. Myers throttled the engine to idling speed and pulled back gently on the stick.

"We'll do stalls first," he said. "Follow through and watch the position of the nose of the plane. To keep the ship from falling off on one wing, I'll kick rudder to keep it approximately level."

The nose of the plane was rising gently into the blue. Higher it climbed. Then an instant's pause. The wings trembled as the plane halted at the top of the climb. Then it shot down like an arrow that has reached the peak of its flight. As the nose fell, one wing started to drop lower. Myers corrected the movement with a quick kick on the rudder. We darted down, nose first, with a sensation like that in the dip of a roller coaster, only this was faster and smoother.

As we started the stall, the stick was clear back against the seat. To stop the dive, Myers pushed the stick forward to neutral position, then pulled it back slightly, and we shot out in level flight. Nothing hard about it. More fun

Ready for a Flight Lesson, and Scene at Department of Commerce Test, Where Student Pilots Attempt to Qualify for License Papers



On Solo at 2,000 Feet, Where the Air Is Cool and Quiet and the Steady "Fledgling" Practically Flies Itself with Almost No Need of Stick or Rudder Control

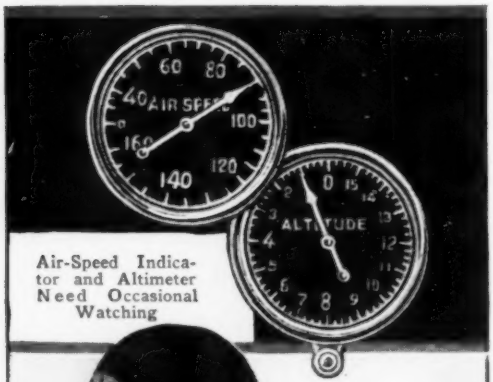
than anything else. We did another after climbing back to our former altitude.

"Now we'll do a spin," said Myers. "We start it just as we did a stall, but in order to spin, we apply full rudder on the side we wish to spin. We'll do one to the left. The stick will be far back against the seat and as we fall, I'll give full left rudder and hold both controls in that position. To come out of the spin, I'll neutralize both rudder and stick, leaving us in a dive. To get out of that, I'll simply pull back on the stick and we'll fly level again. Here we go!"

As the nose of the plane dropped, Myers kicked full left rudder. Instead of shooting straight down as we had done before, the plane started spinning with amazing speed. It was as though we were suddenly caught in some gigantic whirlpool that was sucking us down to the earth with greedy speed. It seemed incredible that our sturdy ship could cut such a dizzy pattern through the skies. Around we went, the motion throwing us against the right side of the cockpits.

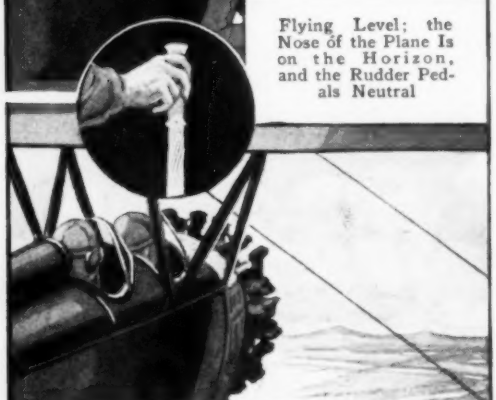
"Notice that I have the stick clear back against the seat and am holding it there with the rudder fully forward at the same time," said Myers calmly. "As long as I hold the controls in this position, we'll spin. Normally, to stop a dive, you push back on the stick. That is just what you don't want to do to stop a spin. Now we'll come out."

He pushed the stick forward to neutral, at the same time the right rudder pedal went forward and the left came back until both were opposite, the neutral condition, and the whirling motion stopped. A slight backward pull on the stick to stop the dive, and we shot out in level flight. To my surprise, we had fallen little more than 400 feet. Myers repeated the spin and then directed me as I went through the same maneuvers. Simple, nothing to fear and the sensation was more pleasant than anything else. I shall never fear a stall or a spin, for I know how to get out of them. Only, and here is the chief reason why the much talked of and little understood spin is a menace, you must



Air-Speed Indicator and Altimeter Need Occasional Watching

Flying Level; the Nose of the Plane Is on the Horizon, and the Rudder Pedals Neutral



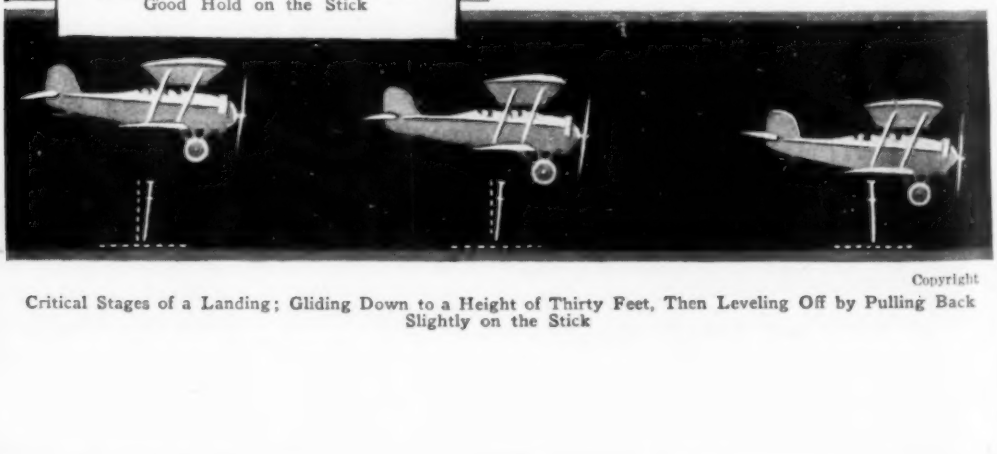
Climbing, the Nose of the Plane Rises above the Horizon; Inset, a Good Hold on the Stick

have plenty of altitude. A spin near the ground would be serious. A stall at low altitude might be equally disastrous.

After stalls and spins, which took but one lesson, the hardest part of the flight instruction proceeded anew— practice on take-offs and landings. The former gave me more trouble than I had anticipated. I had the wrong impression that all one had to do was to give the engine the gun and the ship would fly itself off the ground. That is partly true, but the part that is left out is the rudder, the most important feature of the take-off controls.

Skimming along in the air, a plane steers easily at the slightest pressure on either rudder pedal, but in taxiing or taking off, before flying speed has been attained, the rudder response is much slower and the rudder therefore has to be applied much more vigorously. As the wheels run along, they strike slightly uneven places in the ground, or currents of air swerve the plane. Therefore, unless the ship is steered carefully, it will head crossways into the wind, or, perhaps, turning too sharply, it will touch one wing and a crash will result. To counteract these tendencies, the rudder must be used vigorously and correctly.

Get squarely into the wind. That's the first essential. Have plenty of room ahead of you and be sure the way is clear and that no ships are coming to land behind. Give the engine the gun and, as soon as the ship moves, shove the stick all the way forward. Hold it there just long enough for the nose to come down on the horizon. Don't hold the stick longer. The full forward position is the one for a dive. If you keep the stick there too long, the ship will start a downward course just as it would in the air, the propeller blade will



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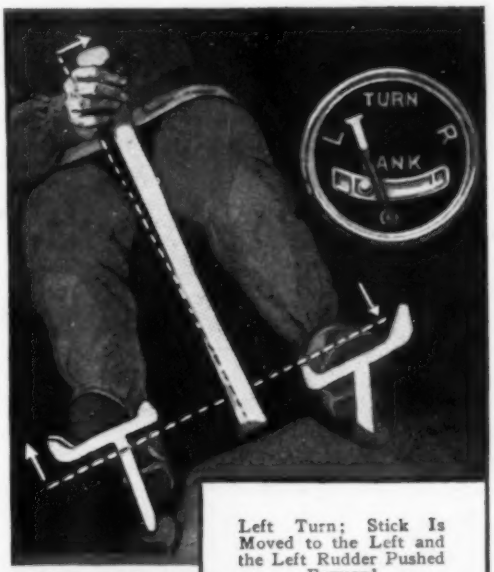
Critical Stages of a Landing; Gliding Down to a Height of Thirty Feet, Then Leveling Off by Pulling Back Slightly on the Stick

hit the ground and there probably will be no more take-offs in that ship that day. But the stick control is easy compared with the rudder.

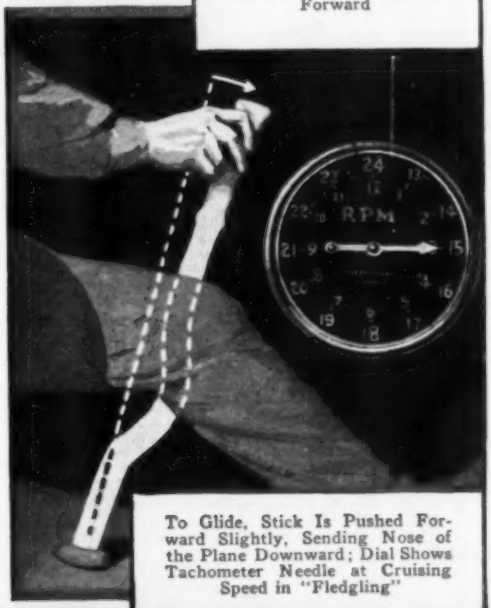
Try to steer a straight course toward a tree or some object across the landing field. If the nose of the plane swerves to the right, apply left rudder quickly and vigorously. Don't hold the left rudder as that would overcontrol. Neutralize the action as soon as the nose is back on the course by a quick application of right rudder. Nose to the left, hit right rudder, nose to the right, hit left rudder; that is the thing to remember. The action is comparatively rapid and must be done correctly. Pressing the wrong rudder exaggerates the swerve of the ship and might result in a spill. As flying speed is gained, the stick drifts back of its own accord.

We were gliding down for the field one afternoon when Myers said, "You land the ship this time. It's all yours. Handle it just as though I were not here." He had cut the gun, the plane was headed straight into the wind and the big brown field was coming up to meet us. I tried to do exactly as I had been told. Glide down to a height of about thirty feet, level off by pulling back slightly on the stick. That slows up the speed. The ship settles a bit in a few seconds. Pull back farther on the stick. The nose lifts a bit higher and, just before you strike the ground, the stick is all the way back against the seat. Easy to describe but not so easy to do.

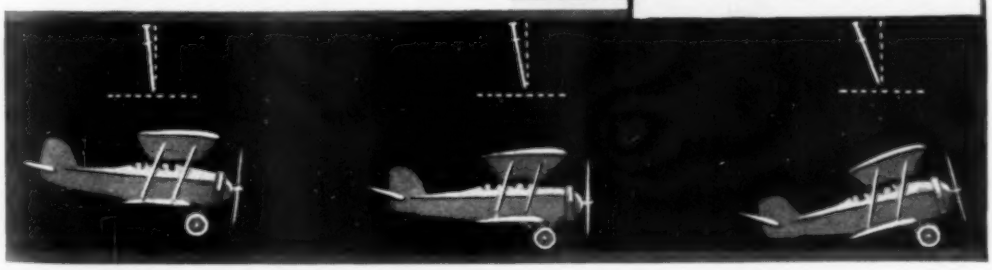
One of the big moments in the student flyer's life is when the instructor climbs out, stays on the field to watch, and his pupil goes up and lands alone. When my time came to solo, Myers waved me off. I gave the engine the gun and No. 6



Left Turn; Stick Is Moved to the Left and the Left Rudder Pushed Forward

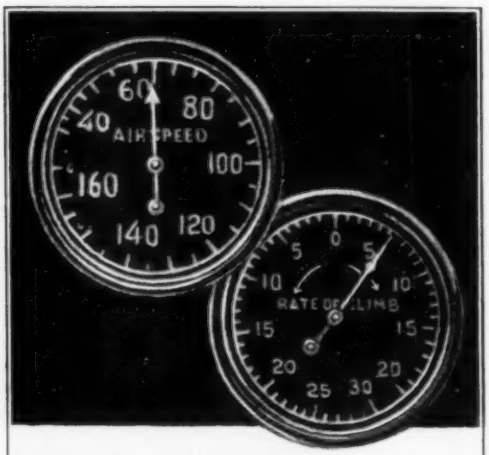


To Glide, Stick Is Pushed Forward Slightly, Sending Nose of the Plane Downward; Dial Shows Tachometer Needle at Cruising Speed in "Fledgling"

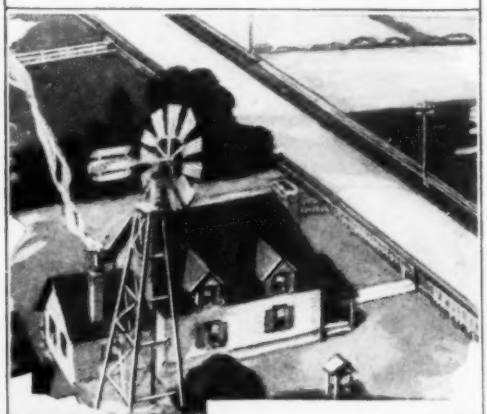


Standard Oil Co.

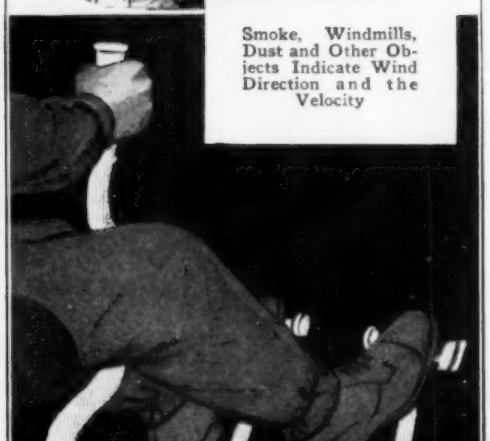
As Plane Sinks, Stick Is Pulled Back Farther, Raising the Nose Until Ship Is in Position to Land on Three Points, Both Wheels and Tail Skid, Simultaneously



Air Speed and Rate of Climb Are Indicated on These Dials



Smoke, Windmills, Dust and Other Objects Indicate Wind Direction and the Velocity



A Poor Stick Hold; Grasping It This Way Encourages Squeezing or "Freezing," and Prevents Pilot from Feeling the Stick's Natural Movements

moved ahead. Far forward with the stick, watch the nose, kick rudder as the plane swerves, let the stick come back after the nose is on the horizon. Faster the brown dirt goes blurring by. I'm off the ground and climbing. Full throttle to about 500 feet. Ease it back until the tachometer shows 1,500. Bank and turn for the first side of the field. I eased back in the seat, let the stick rest gently between my thumb and first two fingers and enjoyed things.

A splendid, sturdy plane, 170 horses in the motor ahead, all under the leash of your throttle hand, cool air sweeping past, the instant response of the wings, the thrill of doing everything yourself and the knowledge that for the first time in your life, you're flying alone!

Here's the western edge of the field. Now for the glide and the landing. I cut the gun and lowered the plane's nose. Out there was Myers, the first time I had seen a human being on the landing field from the air. How small he looked! Gliding down. Something like sliding on greased velvet, perhaps, only much smoother. A rush of wind through the wing wires—good music for it tells you have speed and are not stalling. There's the wind cone. You're headed too far north. Steer straight into the wind. That's better. Over the trees now and right ahead is the field proper. Down gently, no cause for steepening the glide. The wings are shaking a little but a movement or two of the stick levels them up.

This is about thirty feet! Back on the stick just a trifle. Flying level. The plane sinks. Back again on the stick. A little too much that time and the nose rises too high. Don't stall. Getting closer now, here comes the ground and, with a final pull, I moved the stick all the way back against the seat. Just a trifle too soon. I nosed up a bit but landed without too much of a bounce. Not as good a landing as I had hoped for, but the next one would be better.

In taxiing back to Myers who had been watching carefully, I learned another valuable lesson. I tried to turn too soon, applying rudder before the ship had stopped rolling after the landing. Myers warned me against this as there is danger of turning over. Let the plane come to a

halt or nearly stop, unless there is an emergency, and keep it rolling straight after it touches the ground.

"That wasn't so bad," said Myers in commenting on the landing, "but it might have been better. Be sure you have the stick all the way back and don't let your wheels touch first. Try it again and make everything perfect this time."

Away I roared once more, resolved to score a three-pointer. I glided down to a good start but estimated my altitude wrongly. Wheels hit first, rather hard this time, and in pulling back on the stick, something I should not have done, I pulled too hard and too fast and the plane rose fifteen or twenty feet. Remembering orders, I quickly advanced full throttle and shot around again for a third attempt.

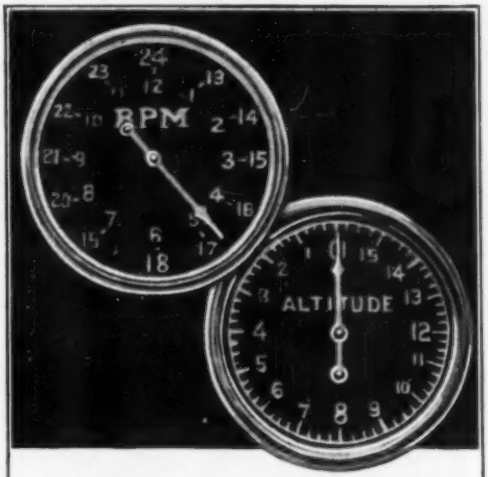
This time it was better. I kept a step ahead of the plane, that is, tried to anticipate the movements and be in time with the settling with a movement on the stick. I looked farther ahead this time, watched both sides and kept special check of the nose position. I didn't hit wheels first and No. 6 stayed firmly on the ground. I rolled nearly to a stop and then turned to taxi back to Myers.

"Seven minutes solo and six hours and forty-five minutes dual instruction before soloing," reported the timekeeper at the office. I tried not to show my elation too much, but a great joy took command of me as I journeyed back to the city. I had soloed!

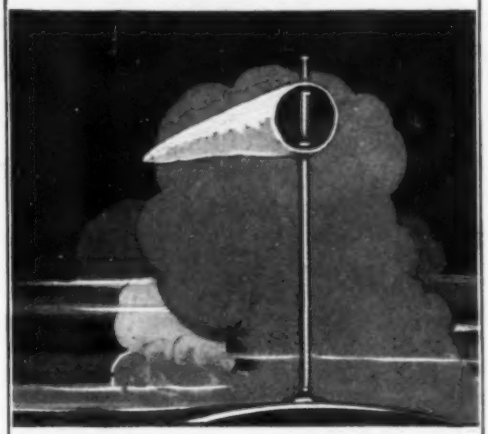
To my surprise, I had not felt nervous when Myers climbed out of the cockpit and let me go alone. Looking back, I ascribe my calmness to two things. First, for some time, Myers had been letting me operate the ship practically alone. Repeatedly, he had told me to manage things just as though he were not there. By careful, logical training he had built up my confidence until it seemed only natural to be starting out alone. Second, before the lesson that day, I resolved to relax and take things more easily than I had ever done before. Again, I repeat, much of the ease in learning to fly lies in that magic word "relax."

"Don't get too cocky now that you've soloed," cautioned the school chief the next day. "You will have a few things to learn!" His prophecy proved correct.

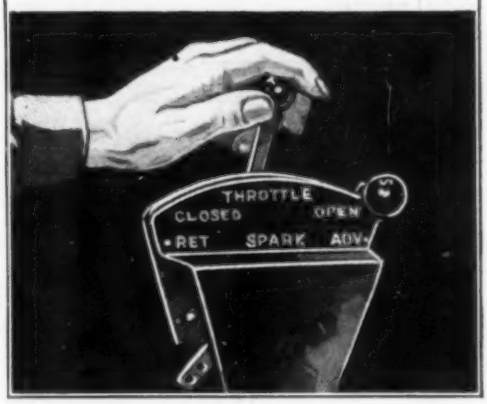
(To Be Continued)



In Warming Up, a Few Seconds of High Speed Indicate if Engine "Revs" Up Properly before Taking Off



The Friendly Finger That Directs the Airman; the Wind Cone Giving Wind Direction



Throttle in "Fledgling" Is Operated with the Left Hand; Here It Is Shown at Cruising Position; the Spark Is Fully Advanced for Flying

BIGGEST NAVAL GUNS HAVE TWELVE-MILE RANGE

Giant Sixteen-Inch Guns on the British Battleship "Nelson"; Note the Elevation Which Is Necessary Because of the Guns' Long Range

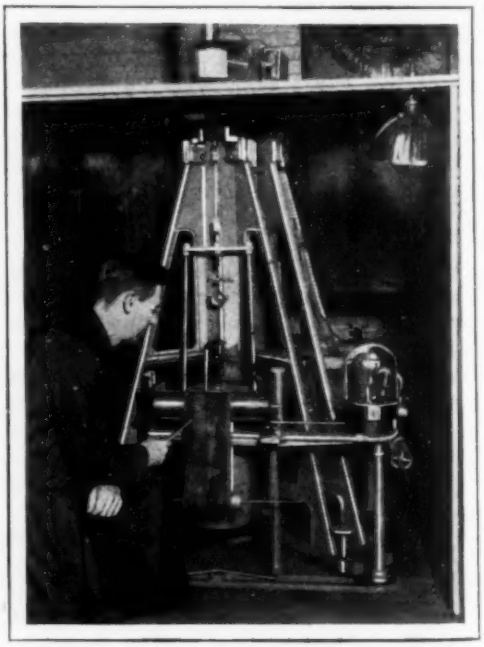
Some of the most powerful weapons in existence today are the giant guns on modern battleships. One of the most effective of the larger weapons is the sixteen-inch gun used on some of the fighting ships of both Great Britain and the United States. These guns, weighing hundreds of tons, are mounted in units of three. They have a range of 20,000 yards and are capable of piercing seventeen-inch armor at half this distance. The cost of firing a triple-turret salvo is about $3,500, and the total weight of a broadside is 18,500 pounds. The high elevation is necessary because of the long range.

WORLD'S TELEPHONE EXCHANGE

London has become the telephone exchange for the world's long-distance calls. Through that city now pass most of the transatlantic telephone messages as well as all the messages to Australia and to most other parts of Europe. A call from Rome to Oklahoma, for instance, comes over land lines from Italy to northern France, then by submarine cable under the English channel and so to the foreign exchange in London. There it is switched to the giant station at Rugby from which it is transmitted across the ocean to New York and passed over land wires here to its destination. Besides all points in Canada and the United States where there are telephone lines, London likewise is connected with Australia, South America, Cuba and Mexico.

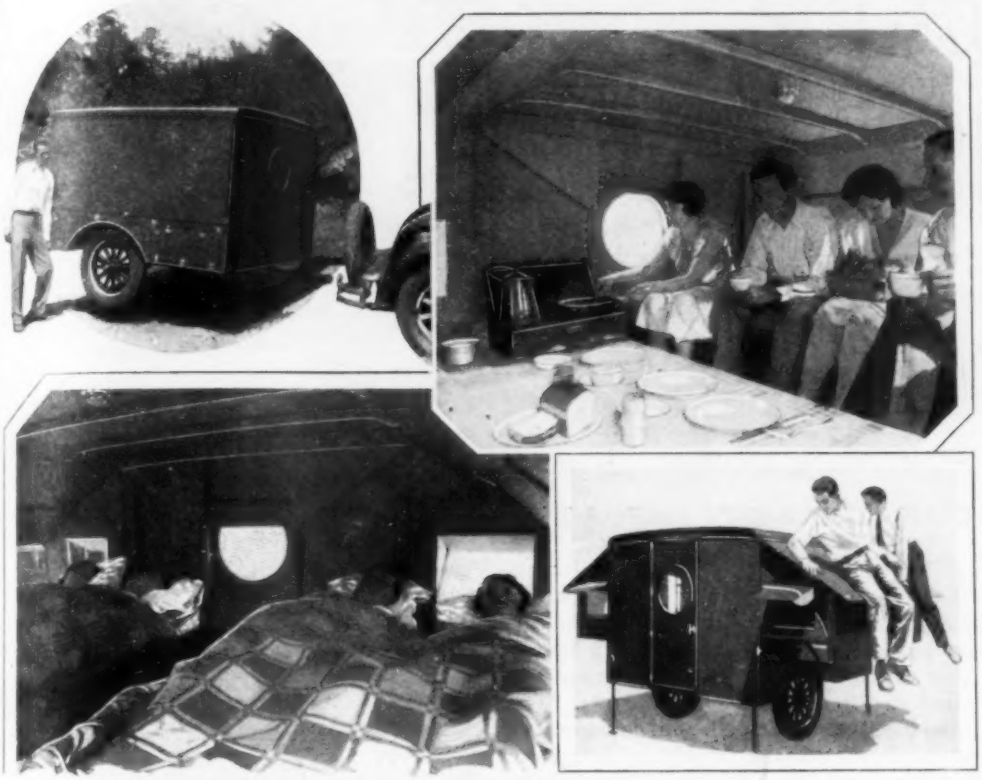
ITALIAN QUAKE IS RECORDED IN AMERICA

When the recent disastrous earthquake shook Italy, the tremors were recorded accurately by the seismograph at Georgetown University. It was estimated that forty minutes were required for the tremors to travel the 4,500 miles from the scene of the quake to the recording apparatus. There are five of these instruments at the Georgetown observatory.



Seismograph at Georgetown University, and Chart Showing the Record of an Earthquake

EXPANDING AUTO TRAILER GIVES HOME COMFORTS

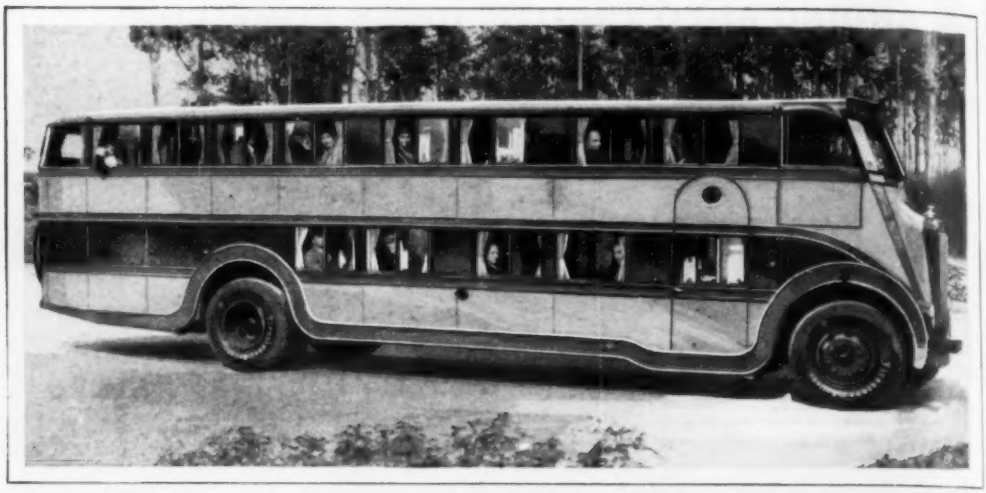


Interior and Exterior Views of an Auto Trailer Which Expands into Commodious Living Quarters; Compact Equipment Transforms the Trailer into Kitchen, Dining Room or Bedroom

Some of the comforts of home are offered in a compact auto trailer which, when expanded, may be used successively as kitchen, dining room, living quarters and bedroom. On the highway, the trailer is no wider than an automobile, but when parked, its sides may be extended by a crank inserted in sockets at the rear. It is provided with extension legs for use when the 800-pound trailer is detached from the car, and has its own lighting plant. On each side of the car is a double bed, half of each folding back to make seats as required, while lockers and closets carry all necessary camping equipment. The trailer is dustproof when closed, and is so designed that making camp is a matter of little more than a minute.

ROCKET TESTS AIDED BY GRANT FROM GUGGENHEIM FUND

So important do scientists consider the experiments with high-altitude rockets designed to explore the upper reaches of atmosphere, that Daniel Guggenheim recently made a grant to Dr. Robert H. Goddard, of Clark University, who is carrying on his experiments at Camp Devens, Mass. Here he has constructed a tower inside of which is a track to direct the path of the rockets at the start of their flight. He has been carrying on research work for several years, and while, thus far, the rockets have only been sent a few hundred feet into the air, the work has reached a stage where it is predicted that they may eventually ascend for fifty or seventy-five miles, carrying instruments to record conditions, and even bringing back samples of the atmosphere from these heights. The rockets used are propelled by the recoil from the discharge of gases.



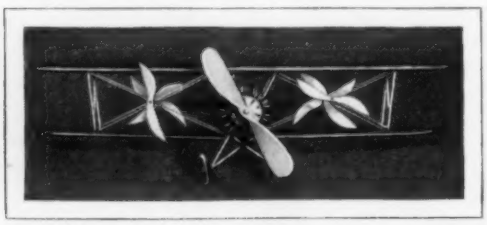
All the Comforts of the Parlor Car Are Contained in Big Double-Decked Motor Busses Like the One Shown Above; It Accommodates Fifty-Three Passengers on Long Inter-City Runs

GIANT INTER-CITY MOTOR BUS CARRIES FIFTY-THREE

Capable of accommodating fifty-three passengers each, giant double-deck motor coaches are being turned out by a Pacific coast coach works to be used in inter-city travel and long cross-country runs. The palatial busses have all the comforts of the modern parlor railroad car and from the upper deck offer a splendid view of the scenery along the highways.

WIND MOTORS FOR AIRPLANES PREVENT NOSE DIVES

To prevent a nose dive when the engine of a single-motored airplane goes dead, an aeronautical expert has made two auxiliary wind motors, placed in the position on the wings of the two outboard motors of a tri-motored ship. The wind motors consist of two-bladed propellers geared to four-bladed propellers in a ratio of two to one, the four-bladed propellers being in the rear. When the main motor dies, the "back wash" drives the wind motors in such a way that the front two propellers of the auxiliary develop a lifting power. Thus the plane rises from the motion given the rear propellers and transferred to the two-bladed ones.



Single-Motored Plane Equipped with Two Auxiliary Wind Motors for Use When the Engine Fails

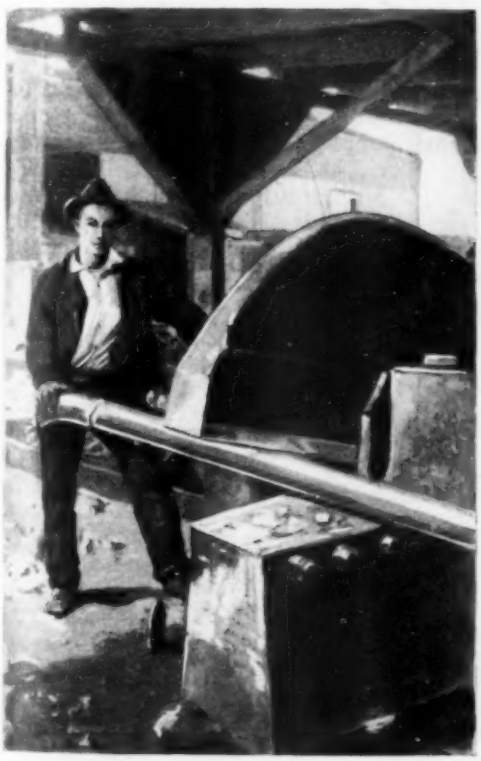
RAYON, SILK'S PRINCIPAL RIVAL, TO UNDERSELL COTTON

Rayon, the principal rival of silk, and other synthetic cellulose fabrics, will soon be underselling cotton goods just as they now are priced under silk. This is the prediction of Prof. Charles E. Mullin, head of the division of textile chemistry at Clemson College in South Carolina. One company already can produce viscose yarn at a lower price than that of medium or fine grades of cotton yarns. As soon as the prices of the synthetic yarns drop to near that of cotton yarns generally, the same result will be apparent in the case of cotton goods, Professor Mullin says. He has found that synthetic silks are competing with real silks not only in price but in quality, since it is now possible to produce filaments more than twice as fine as those of true silk. It requires more than 4,225 miles of one of these filaments to weigh a pound, and six pounds would encircle the world.

¶Iodine has been found in coal by German scientists.

Junking Old Warships

WHAT becomes of the fighting ships of yesterday—ships such as those with which, thirty-two years ago, in the harbor of Manila, Commodore George Dewey destroyed the Spanish fleet? Though they were formidable fighting craft in their day, it is significant of the rapid progress that has been made in naval construction, that Dewey's entire squadron, consisting of six warships, representing a total of 19,000 tons, was less in tonnage than one modern battleship.

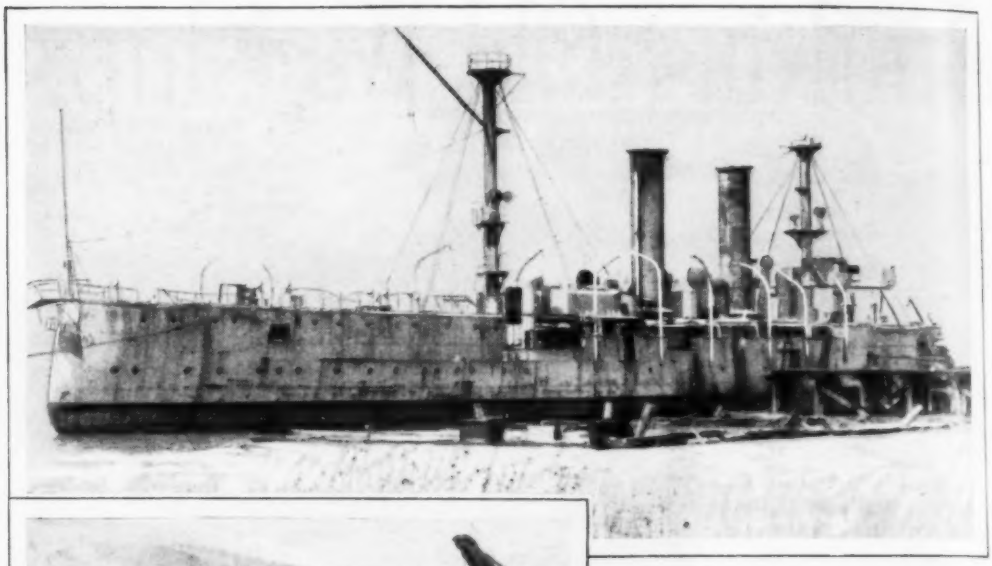


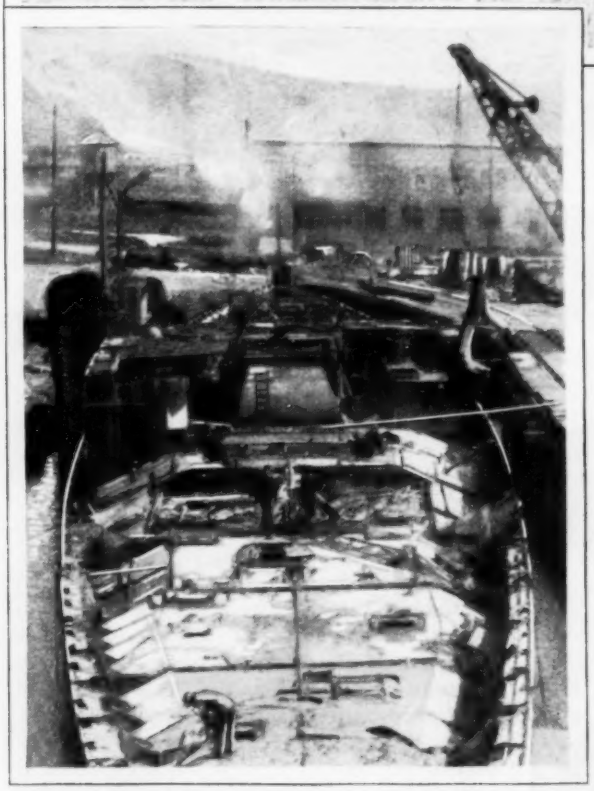
Salvaged Vessel Ready for Cutting with Acetylene Torches, and Shearing Steel Pipe and Copper Tubing

The buyers of these condemned warships, in most instances, are firms which specialize in breaking up old vessels for their steel, copper, brass and marketable fittings. The steel is eventually manufactured into nails, bolts, wire, tin plate and other hardware. Ship fitters purchase most of the salvaged fittings, and the copper and brass are sold to manufacturers in the United States and Europe, to find their way back into the world in various commodities.

With the hull of a partially scrapped battleship high in the water alongside a wharf; busy workmen on the ship and ashore; on its track of steel an electric crane towering high above the ship, a view of a ship-breaking yard from a distance suggests a shipbuilding scene. But closer inspection and the junk-strewn yard tell another story. Here are the spoils from many scrapped ships, both merchantmen and men-of-war.

In one end of the cluttered yard, amid a mass of steel wreckage, varying from huge smokestacks to sections of thick armor plate, workmen, grotesquely masked, are at work with cutting torches; and here, like wheat separated from chaff, are





Obsolete Battleship Ready for Firing to Destroy All Woodwork, and, Below, Cutting Up a Metal Hull; Not a Pound Is Wasted

anchors, ship wheels, gratings, fathoms of rusty chain, blocks, wire rope, spars, and a miscellany of other salvaged fittings.

Primitive fire and the cutting torch, the former to rid the ship of deck planking and other woodwork not worth salvaging, and the latter for cutting the steel decks and other parts into sections which can be handled by crane, are the principal tools of the ship breaker. Equipped with cutting torches, a comparatively small force of workmen in less than a year can scrap a battleship which required several years and scores of skilled workers to build.

The first step in the junking process is the removal of the more valuable machinery and fittings, such as pumps, dynamos and searchlights, following which the ship is made ready for burning. To prevent undue damage, the ship is fired a deck at a time. This is accomplished by laying oil-soaked kindling over the deck planking and igniting it. The burning usually is done with the ship anchored offshore, and with flames leaping from the hatches and portholes, and smoke rolling high above the ship, the effect is spectacular. When the burning, requiring several days, has been completed, the ship is reduced to a heat-buckled, fire-blackened hulk. The vessel next is moved alongside the wharf, where are crane, rail and other facilities.

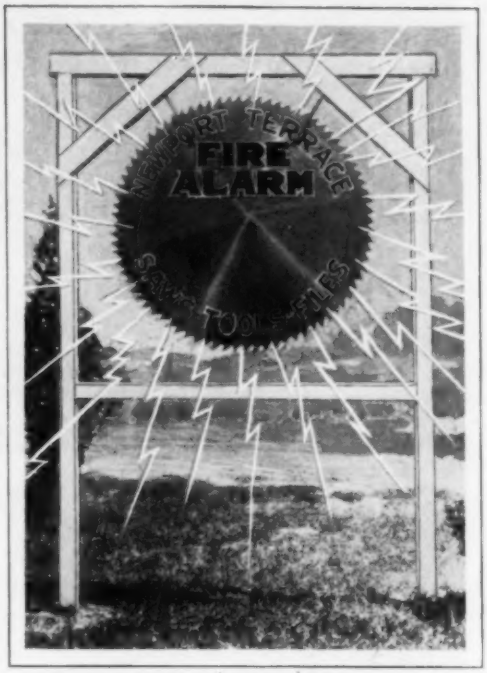
Torch men then attack the steel deck, cutting it into sections. As rapidly as the sections are cut, they are hoisted, amid

a cloud of smokelike dust, and swung to shore. Not a pound of convertible metal is wasted by the ship breaker. When the hull has been scrapped to a few inches above the water, it is towed into a specially constructed basin resembling a drydock. The gates of the basin are closed and the water pumped out. As the water drops, the keel comes to rest on timbers, and the breaking up is continued until the last scrap of steel has been reclaimed.

BETTER PLANE-GUN MOUNTING SOUGHT BY UNCLE SAM

Wanted! A better way for doing this. This picture shows an airplane gun mounting which is the same kind used during the war and which has not been improved since. But now, with airplanes flying 175 miles an hour, the gunner in the rear seat cannot swing these heavy and cumbersome mounts against the terrific wind blast and centrifugal force which is set up. The latest attempt in developing a better mount was made by putting a wind vane beneath the fuselage which would help move it, but when tests were made the vane, small as it was, tended to act as a rudder and steered the plane off at an angle. The ideal mount would be one that is not in the way of the gunner or passenger, yet is flexible enough to work easily. No country has developed a satisfactory machine-gun mount for movable guns.

Airplane Gun Mount of Type Used Since the World War; a More Efficient Mounting Is Sought



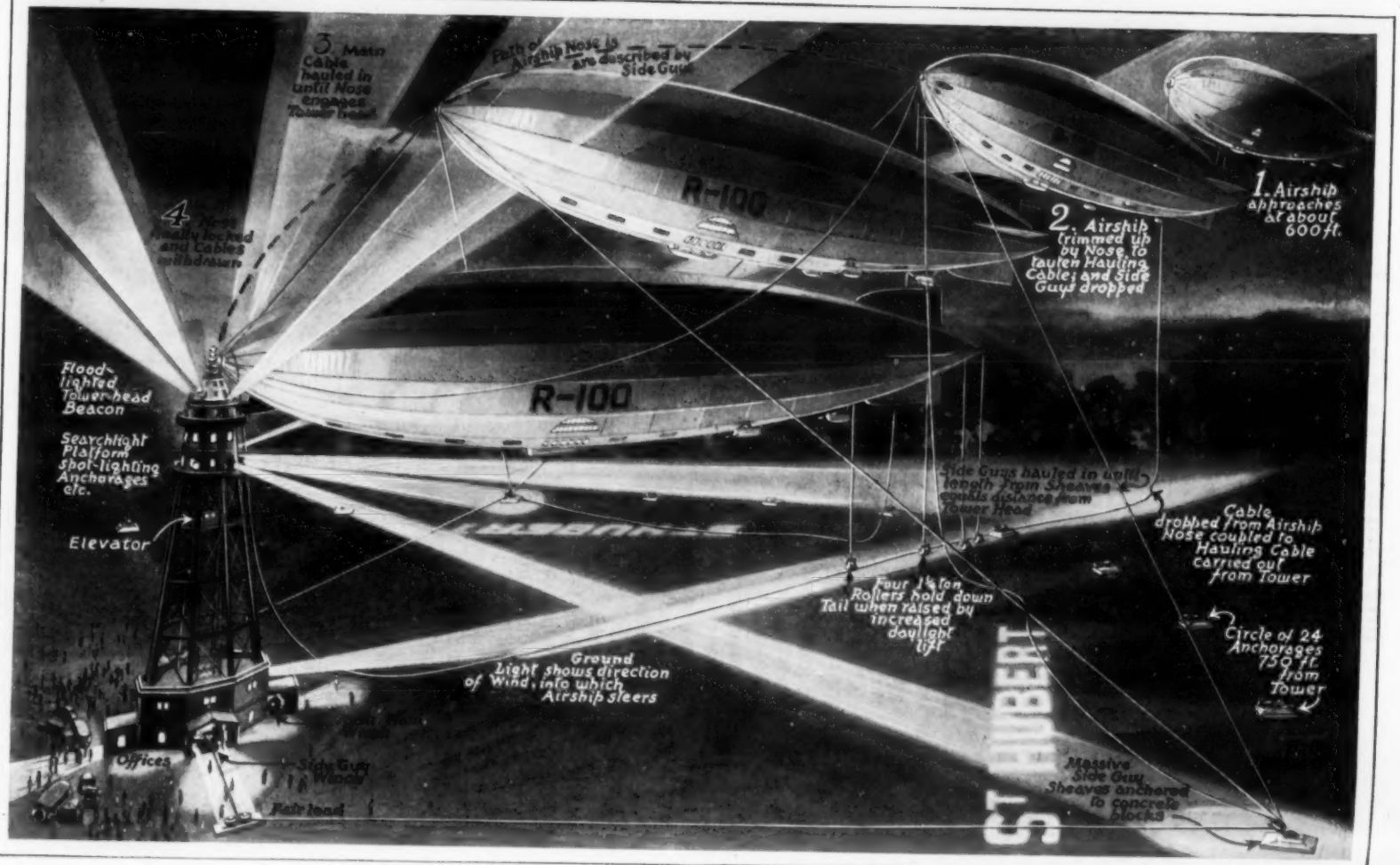
Old Circular Saw Suspended from a Frame, Where It Serves as a Fire Alarm for a Small Town

TOWNS USE WORN-OUT SAWS AS FIRE ALARMS

Small towns and communities are besieging a saw factory for worn-out circular saws which are being employed as fire alarms. The saws are mounted on wooden frames, so suspended that when struck, a gonglike sound is produced that can be heard for great distances.

AIR-LAW VIOLATIONS ARE INCREASING

During the second quarter of 1930, the aeronautics branch of the department of commerce heard 177 cases of violations of air-commerce regulations, representing an increase of fifty-five over the first quarter. Fifty-three persons were fined a total of $900 while sixty-three licenses were suspended, twelve revoked and five denied. Of the violations, thirty-two were committed on account of acrobatics, thirty-one by low flying, fifteen for an unlicensed pilot flying a licensed plane, and others for minor offenses.


3. Main Cable hauled in until Nose engages Tower Head
Path of Airship Nose is described by Side Guys
1. Airship approaches at about 600 ft.
2. Airship trimmed up by Nose to tauten Hauling Cable; and Side Guys dropped
4. Nose locked and Cables withdrawn
R-100
R-100
Flood-lighted Tower-head Beacon
Searchlight Platform Spot-lighting Anchorages etc.
Elevator
Side Guys hauled in until length from Sheaves equals distance from Tower Head
Cable dropped from Airship Nose coupled to Hauling Cable carried out from Tower
Four 1 ton Rollers hold down Tail when raised by increased daylight lift
Circle of 24 Anchorages 750 ft. from Tower
Ground Light shows direction of Wind, into which Airship steers
Offices
Side Guy Winch
Fair lead
Massive Side Guy Sheaves anchored to concrete blocks
ST. HUBERT

Sketch of Latest Type of Mooring Mast for Dirigibles, Showing the Lights, Tackle and Winches Used in Bringing a Big Airship to Anchor; Note the Ground Light That Indicates the Direction of the Wind for the Guidance of the Airship Crew

Sketch of Latest Type of Mooring Mast for Dirigibles, Showing the Lights, Tackle and Winches Used in Bringing a Big Airship to Anchor; Note the Ground Light That Indicates the Direction of the Wind for the Guidance of the Airship Crew

POWER OF FUTURE FROM SOIL, AIR AND SUN

Water, soil, the air and the sun may be expected to furnish the power for future generations in the opinion of Dr. Herbert Levinstein, president of the Society of Chemical Industry. He estimated that the world's principal coal deposits will be exhausted in about fifteen more generations. Chemical science has already reached a stage where it can obtain direct access to new sources of coal-tar products by a synthetic process. A complete reduction of carbonic acid, obtained from the air, to methane or coal gas, has been accomplished, and this, in turn, can be converted, in an arc oven, into acetylene or changed into tar, half of which consists of benzine. The supply of carbonic acid in the air is inexhaustible.

"MERCY" BULLET BRINGS SLEEP INSTEAD OF DEATH

Capturing wild animals alive after administering a long-distance anesthetic now is possible by using the "mercy" bullet, which is similar to a hypodermic needle in construction, except that it can be fired from a gun. The missile renders an animal helpless within two minutes by producing a deep slumber, but the effects disappear completely after an hour or so. It is believed the bullets will make possible the capture of wild animals in the jungle without resorting to traps.

Penny Golf Course for Children Modeled after Miniature Courses Popular with Grown-Ups; It Has Sea-Shell Hills and Coffee-Can Hazards

CHILDREN'S PENNY GOLF LINKS LIKE MINIATURE COURSE

Taking advantage of the miniature golf-course fad, four Cleveland girls recently opened a penny course for children, the nine-hole homemade course being laid out on a narrow plot of ground between two houses. Hills on the course are banked with sea shells, while tunnels built of lacquered coffee cans form difficult hazards. Children under seven pay a penny to play, while those from eight to fourteen are charged two cents.

TENNIS BALL VISIBLE IN DARK HAS LUMINOUS COATING

For those who like to play tennis at dawn or dusk, a ball that is visible in the dark is being introduced in England. The luminous balls are given a coat of phosphorescence by treating them with sulphur in a special process. The luminous quality does not tend to slow the balls during play nor damage the racquet.

Barefoot Shoe Peddlers in Persia Who Would Rather Carry Their Wares Than Wear Them

SHOE PEDDLERS GO BAREFOOT TO SAVE THEIR WARES

Shoe peddlers from Teheran, Persia, walk hundreds of miles to their market, carrying their stock about their necks and traveling barefoot rather than wear out any of their merchandise. Often these itinerant merchants walk for months before disposing of their goods, but never do they consider using the shoes and boots themselves.

SMELLS ARE PUT TO WORK

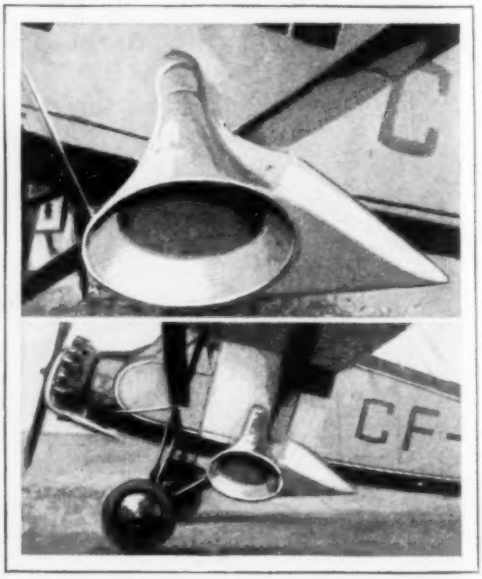
One of the secrets of the perfumers' art is being applied by manufacturers of linoleum, glue, textiles, rubber goods and other products which have an unpleasant odor. The perfumer puts unpleasant smells to work to blend the more pleasant odors he adds to produce a pleasing scent, and manufacturers are using the unpleasant smells as a base to which to add industrial aromatics, which either neutralize the offensive odor or blend with it to form a pleasant smell. It has been found that goods which ordinarily smell worst are the ones which, by these applications, can be made to smell the best, but without being perfumed.

LAWN SPRINKLER ON THE ROOF KEEPS BUILDING COOL

Lawn sprinklers have been installed on the roof of an Omaha apartment building to lower the temperature during extremely hot weather. With the mercury at 107 degrees, the manager of the building succeeded in bringing down the temperature ten degrees by keeping the sprinklers in operation.

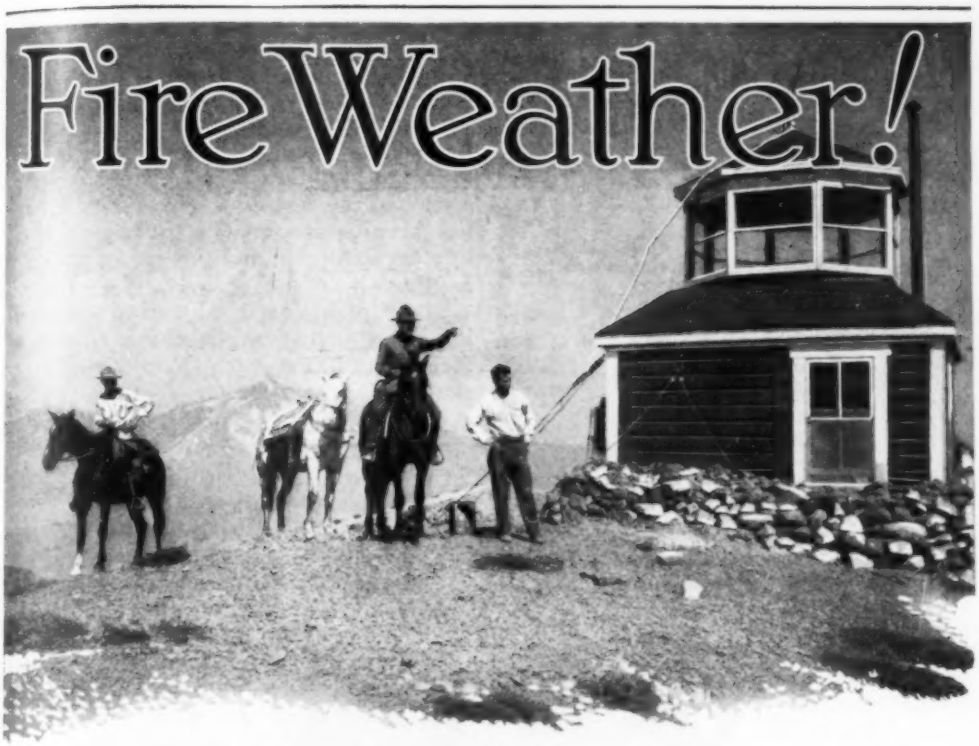
VOICE FROM THE SKY CARRIED BY HORNS ON PLANE

From an airplane in flight words and music were broadcast recently for the first time in Canada through eight loud-speaker units extending from the sides of the ship. When attempted in this country, the loud speakers have been placed under the plane instead of projecting from its sides. The broadcasting equipment, magnifying the microphone input several million times, consists of eight loud-speaker units, such as used in theaters, mounted at the end of a large horn projecting through the cabin wall and carefully streamlined. Each pair of loud speakers is fed by one of four amplifiers. The entire apparatus weighs only 600 pounds and was clearly audible on the ground when the ship was at an altitude of 4,000 feet.



Airplane Used for Broadcasting in Flight; Note the Streamlined Horn Containing Loud Speakers

Fire Weather!



Rangers Watching Progress of Forest Fire from Lookout Station on Top of Mt. Eddy, California; Mt. Shasta Is Seen in the Background

By CHARLES FITZHUGH TALMAN

THE WORD "humidity" is familiar to the man in the street as the name of something that adds to weather discomforts in the dog days. "It's not the heat, it's the humidity," is a classic explanation of sensations too well known to all Americans. To loggers and lumbermen the word has, in recent years, become equally familiar in another connection.

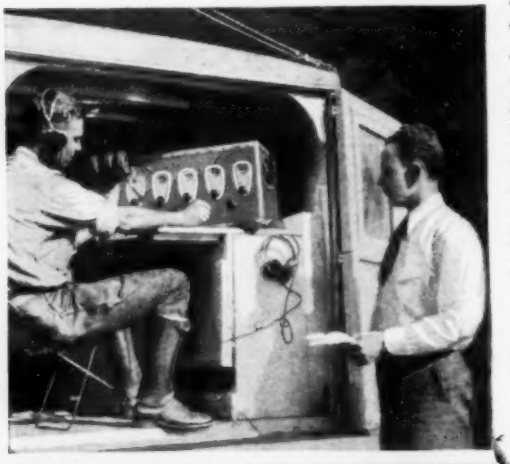
Striking relations have been found to exist between certain types of weather and the prevalence of forest fires. Some states of the atmosphere are conducive to fires; others check or prevent them. In both cases, the weather element that plays the leading part is humidity. High humidity is a safeguard against forest fires. Low humidity is the worst fire hazard of the forest.

Weather that promotes the spread of forest fires is called "fire weather." In its extreme forms it leads, when other conditions are favorable, to such startling performance of the "red demon" as the veritable epidemic of fires witnessed early last May in the northeastern states. Woods and fields were ablaze at scores of different places at the same time; several towns, including Nashua, N. H., were damaged by the flames, and the toll of losses mounted up to sixteen million dollars.

Little rain had fallen for weeks before these fires and they were attended by high winds, but the principal atmospheric cause of the disaster was the excessive dryness of the air.

"It's not," explained the forestry experts, "the drouth or the wind, it's the low humidity." And the same diagnosis is passed nowadays on the majority of big forest fires.

Low humidity means little moisture in the air, and high humidity means much. The moisture is not a liquid, but an invis-



ible gas called water vapor. It is not directly perceptible to the human senses, though in an indirect way it affects comfort in both hot and cold weather.

The capacity of the air for water vapor varies with the temperature; the warmer the air, the more it can hold. The actual amount present at any time in a unit volume of air is called the absolute humidity, but this has little to do with forest fires. The thing in which foresters and fire fighters are interested is the relative humidity—the ratio between the amount of water vapor present and the greatest amount the air can contain at the prevailing temperature. This is expressed in percentage. One-hundred per-cent relative humidity means that the air is fully charged with water vapor, so that any lowering of its temperature would cause some of the vapor to condense.

Measuring the relative humidity of the air as a test of the fire hazard is rapidly becoming a routine practice among American woodsmen. In the Douglas fir region of Washington and Oregon, humidity instruments are found universally in logging camps, because a logger cannot get insurance on his equipment and felled timber, except at prohibitive rates, unless he agrees to maintain such instruments on his operation and to suspend work whenever the humidity falls below thirty per cent. In the Pacific northwest this value has become a somewhat arbitrary deadline between safe and unsafe weather for logging.

The explanation of why relative humidity is so important in connection with forest fires begins with the fact that both the start and the spread of a fire depend upon a certain degree of dryness in the forest fuels. The living vegetation of a forest contains, of course, a supply of moisture that is independent of weather and varies chiefly with the season of the year, but the principal fuels of the forest fire are the litter, logs and dead trees, the moisture content of which is controlled by atmospheric influences.

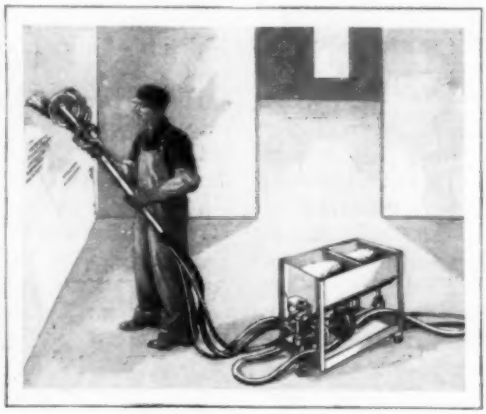
Rangers Receiving Radio Weather Report; Using Portable Phone, and Measuring Dryness of the Air

These dead materials of the forest are all more or less hygroscopic. This means that they readily absorb moisture from the air when the latter is well supplied with water vapor and lose moisture rapidly by evaporation when the air contains little water vapor. Hot weather and wind both tend to increase the rate of evaporation, but they are less effective in this respect than low humidity.

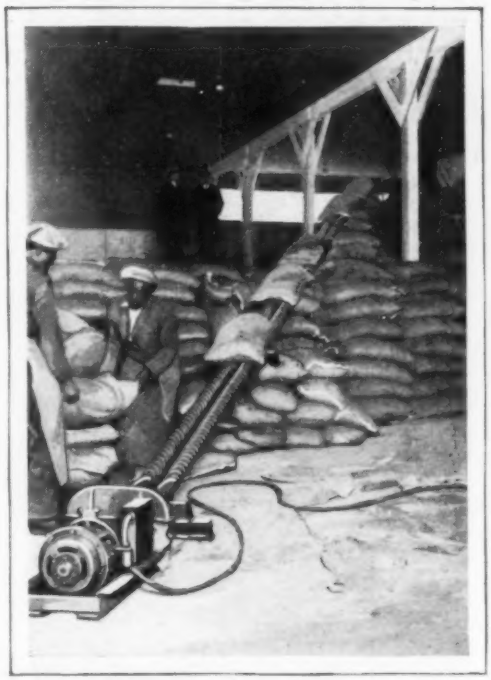
The study and prediction of fire weather have been added to the manifold jobs of official meteorologists in the United States and Canada. Special fire-weather services have been organized in the principal forested areas of both countries for the purpose of keeping watch of weather conditions affecting forest fires and issuing timely bulletins and warnings on the subject. As an aid in protecting the forests from fire these services are now recognized to be second in importance only to the vast system of patrols and lookouts that has been maintained in the forests for many years. The latest adjunct of this service is the fire-weather truck, which takes instruments, a radio outfit and two men directly to the scene of a fire, where observations are taken, weather maps drawn and forecasts issued with due regard to local conditions that would, as a rule, be unknown to a distant forecaster.

PLASTERING DONE BY AIR CUTS DOWN HARD WORK

Operated by compressed air, a plastering machine which mixes and applies plaster to the walls has been made by a California inventor. The familiar trowel with which plaster has been applied for centuries, is used only to spread the material. The machine works effectively over all plaster bases, including wood and metal lath, plasterboard, wire, paper, concrete or brick. It handles both interior and exterior coats.



Plastering Machine Operated by Compressed Air, Which Mixes and Applies the Coating

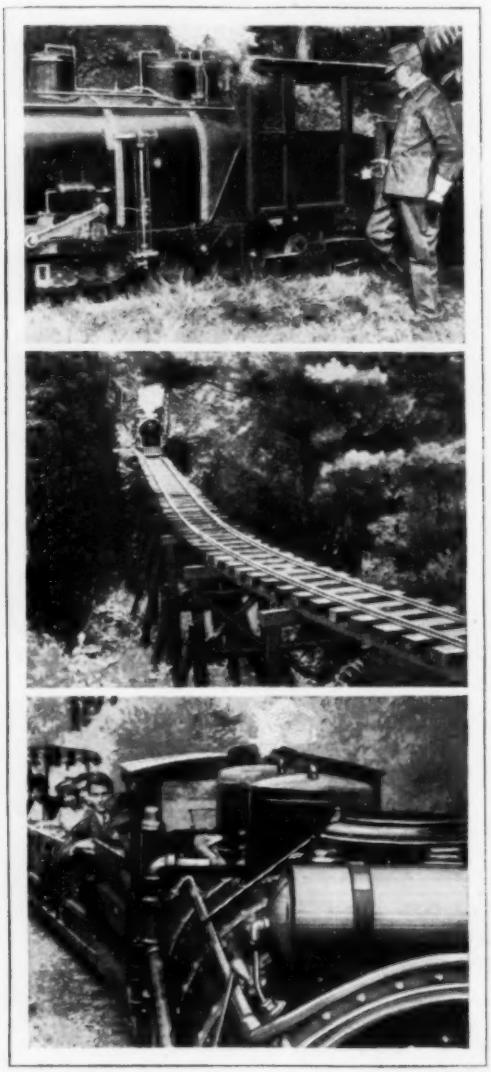


Twin-Screw Electric Conveyor Whose Revolving Spiral Tubes Move Bulky Articles Quickly

TWIN SCREWS REPLACE BELTS IN MOVING SACKS

Combining the advantages of a tiering machine, escalator and belt conveyor, a twin-screw electric conveyor has the additional features of being both flexible and portable. It was first used in sugar warehouses where it moved sacks up a thirty-per-cent grade at the rate of ninety feet a minute, handling 1,800 bags an hour. Aside from the motor, the machine consists of parallel screws turning toward each other. Additional sections may be connected to provide any desired length, and since the system is both flexible and portable on a hand-truck, commodities may be routed to any part of a factory or warehouse.

"SHERLOCK HOLMES" BUILDS MINIATURE RAILWAY



Views of Homemade Locomotive and Railroad That Winds through Grounds of a Private Estate

In order to realize in part his boyhood dream of becoming a railroad engineer, William Gillette, the actor, has built a private railroad on his estate near Hartford, Conn., with which to entertain himself and his friends. The little engine, built to scale, pulls a train of cars over tracks which run through tunnels, over trestles and beside beautiful gardens and wooded sections. From the train, the passenger gains a view of most of the estate during a round trip over the system. Mr. Gillette, famous for his portrayal of Sherlock Holmes, built his cars without tops, to make them better for sight-seeing purposes.

CHEMISTRY TOUCHES ALL LIFE MAKING LIVING EASIER

A chemist recently addressed an audience of business men. "I will talk a half hour on the chemistry of anything in this room," he challenged. Up spoke one of his hearers. "Take my watch," he offered with a knowing smile. "You can have all the chemistry you can prove is in it." The chemist jumped at the chance. He described the chemistry of an ordinary gold watch, the chemically controlled baking that makes its dial from rare zirconium, the cyanide process of gold extraction, the wonderful alloys immune to temperature changes, crystal glass and steel spring, luminous dials of mysterious radium. The chemist could just as well have talked about a plate, a spoon, the chairman's cigar or the paint and paper on the walls, for all about him was chemistry, as it is all about us every day, waiting only to be revealed by the initiate. The chemist is one of the most indispensable of scientists, adventurer into unknown realms, servant of progress. In the midst of life we are in—chemistry. A chemically made spring sets off the alarm that wakens us in the morning; at night we slip between chemically bleached sheets. While we sleep, the chemical process of respiration goes on. Chemistry supplies also most of the things used to prepare your breakfast. Utensils of aluminum, chemically extracted from clay or enameled with chemical compounds, are first to strike the eye. Besides the rustless knives, the table holds glasses of soda, lime and sand. Your office desk may be covered with plate glass. Upon it are appliances made of another marvelous product of chemistry, rubber. Your telephone and its insulated wires, your typewriter, fountain pen, eraser, rubber bands and stamps, even the galoshes and raincoat behind the door, are due to chemistry. Then you drive home from the office in an automobile that is almost a traveling chemical exhibit, with gasoline engine, rubber tires and many parts

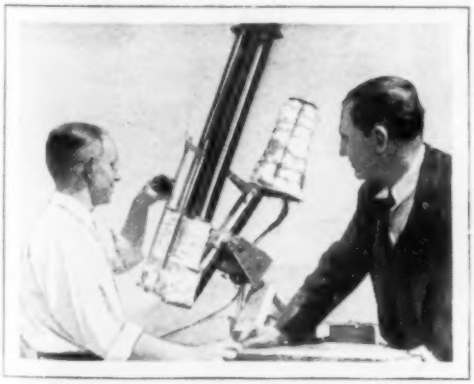
made by chemical process. Arrived home, you may walk in your garden, that is another chemical factory, where plants build up complex compounds from simple materials. Soluble chemical compounds are brought from the soil by the sap. The cleverest chemists have not yet duplicated nature's work in the garden.

EGGS SOAKED IN MINERAL OILS LOSE LESS WEIGHT

Eggs with oil-soaked shells have been found by the department of agriculture to lose less weight from shrinkage and evaporation than untreated eggs. In experiments, eggs were treated with two different kinds of oil, both at ordinary atmospheric pressure and in a vacuum. They were kept for ten days at a temperature of ninety-eight degrees and weighed at regular intervals. It was found that untreated eggs lost about thirteen per cent in weight, those dipped in mineral oil at atmospheric pressure lost two per cent, and eggs dipped in aluminum soap oil under vacuum lost only one-half of one per cent.

SUNNIEST SPOT ON CONTINENT SCENE OF TEN-YEAR TEST

Scientists of the Smithsonian Institution have selected Table mountain, 100 miles from Los Angeles, as the location of their solar observatory because the mountain is believed to be the sunniest spot in North America, although not the hottest. From this mountain a constant watch is to be kept on the sun for the next ten years.



Pyrheliometer, an Apparatus with Which Scientists Measure the Intensity of Solar Radiation

AUTOMOBILE CHAIR FOR BABY HAS ADJUSTABLE LEGS

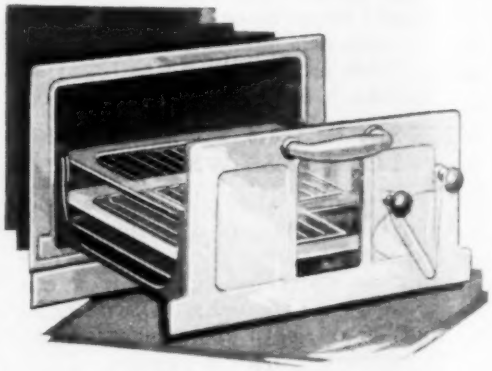
An Auto Chair for the Baby; Insert Shows How It Can Be Folded When It Is Not in Use

For the comfort and safety of the baby, an auto seat for the car with removable cushions is available. The feet of the back frame are adjustable and are placed under the car cushion, holding the baby chair firmly. The front legs also are adjustable to conform to the thickness of the cushion on which they rest. When not in use, the seat folds against the back of the car.

BALLOON TO GO UP TEN MILES WITH TWO PASSENGERS

For scientific exploration of the upper atmosphere, a Brussels scientist is preparing for a balloon ascent of 50,000 feet to be attempted at Augsburg, Bavaria. As the air pressure at this height is too low to maintain human life, the gondola of the balloon will be constructed on the diving-bell principle. It will consist of a hollow aluminum sphere, about six feet in diameter, hermetically closed and fitted with oxygen supply and breathing apparatus. It will be provided with outlook windows for the scientist and an assistant.

New Conveniences



This Broiler Compartment for the Stove Has Window through Which Foods Can Be Watched, and the Pan May Be Raised or Lowered as Desired Simply by Moving the Lever at Side; the Drawer Is on Roller Bearings for Smooth Operation

Above Is a Wall Mop of Special Material to Remove Dust, Smoke and Stains from Walls with a Minimum of Labor and Trouble; It Is Virtually an Eraser and May Be Attached to a Broom Handle

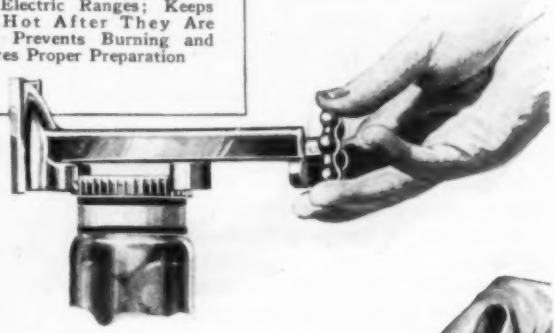
At Left, an Electric Lamp, the Base of Which Conceals a Grill That Is Used as Illustrated Below; Toast Browned on the Grill May Be Kept Warm by Placing It under the Bulb as Shown

This Electric Cooker with Strainer Top Has Handy Base to Protect Table and Operates from Lighting Socket; Can Be Used for Many Purposes and Is of Convenient Size

for your Home

Wrapper for Silverware Is Chemically Treated to Prevent Tarnish When Articles Are Covered; It Absorbs the Substances That Usually Cause Discoloration; Slips into Drawer or May Be Left on Top of Buffet

Four-Compartment Steamer May Be Used on Gas, Coal, Wood, Oil or Electric Ranges; Keeps Foods Hot After They Are Cooked, Prevents Burning and Insures Proper Preparation



Opener Safely Removes Tops from All Types and Sizes of Screw-Cap Jars, Bottles and Sealed Glass Containers

Vacuum for the House-Cleaning Outfit Is Created by the Water System and Carries off Waste and Dust through Tubes to the Sewage; No Bag Is Used and Operation Cost Is Low

At Right, Below, Two-Prong Fork Removes Seeds from Grape Fruit without Wasting the Meat; Takes Two Seeds at a Time

NAME TANNED ON NEW BABIES FOR IDENTIFICATION

Water-Cooled Violet-Ray Lamp Used with Stencil to Tan Names on Backs of New-Born Babies

Following a dispute between parents as to the ownership of two babies born on the same day in a Chicago hospital, the city health department is considering a plan to brand the names of all new-born babes on their backs with an ultraviolet-ray lamp. The lamp is used with a stencil to brand the name of the infant in sun tan on its skin. The name would disappear in about six months.

INTERIOR DECORATION OF LINER NEEDS "INTERNATIONAL" ART

Decorating the interiors of the "hotels within hulls," the modern ocean liners, has been one of the most difficult problems of the owners and has given rise to a sort of international movement in art, since the steamers are international in character. Some companies have successfully broken away from the strictly ship idea in the decorations and have followed hotel designs and furnishings. This is said to be particularly true of the German, Dutch and French liners. In recent years, decorating the big steamers' interiors has been taken out of the hands of the shipyard men and placed under the direction of specialists who realize that an unusual style of decoration must be adopted to appeal to the mixed passenger lists made up of persons from many nations.

NOW YOU CAN BUY INSECTS

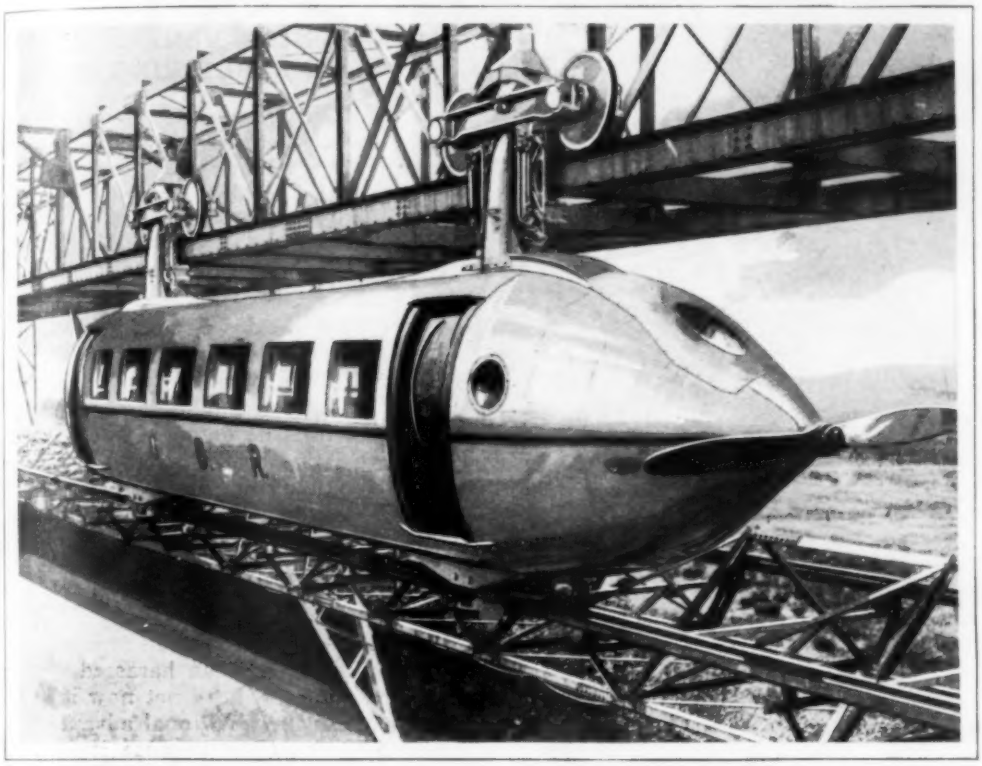
Insects are being raised and marketed in California for $10 a million, or a penny a thousand. The insects that have a cash value are the almost microscopic wasps, known as "trichogramma," which prey on the eggs of other insects, thereby preventing an increase in the numbers of the harmful kind. An entomologist has been rearing them, and has improved his methods until he can produce a thousand of them for a cent. They are sent in great numbers to orchardists who release them to assist in warfare on insects preying on fruit.

SLASHED SHOE SHOWS POWER OF AIRPLANE PROPELLER

No better illustration of the deadly menace of a whirling airplane propeller is afforded than the accompanying picture of the slashed shoe which was cut in four places in one-seventh of a second when the pilot's foot came in contact with the blades. The co-pilot of an army bomber was thrown from the front cockpit as the ship dropped suddenly, but almost miraculously saved his life when he fell into the falling plane. As he grasped the ship, however, his foot came in contact with the steel propeller, which was turning at 1,750 revolutions per minute, or thirty per second. So intent was the aviator on getting back into his ship that he did not know his foot had been injured until he was seated in the cockpit again.

An Airplane Propeller Slashed This Pilot's Shoe Four Times in One-Seventh of a Second

SUSPENDED RAIL CARS DRIVEN BY AIR PROPELLERS



Railplanes, Combining Railroad and Airplane Transportation; the Cabin Car Is Suspended from an Overhead Steel Girder and Air Screws, Front and Rear, Provide the Power

Railplanes, streamlined railroad cars suspended from an overhead rail and driven by airplane propellers fore and aft, are undergoing successful tests in Scotland as a means of providing fast passenger service. Routes for the railplanes would be built along existing railways, thus involving a relatively small expense. The cabin cars are suspended from a steel girder and air screws provide the power.

AIR BRUSH THAT DOES NOT CLOG WORKS UNDER PRESSURE

Spraying all kinds of liquids and paints without clogging, a hand-operated air brush that is exceedingly simple in construction has a variable nozzle for the different adjustments or materials, thus avoiding interchanging. All the air used in the system is forced down a tube to the bottom of the jar containing the paint, where it agitates the spraying material, and also forms the pressure that forces the paint through another tube and out the nozzle. The paint tube is screened so that particles cannot get through and clog the nozzle, and the air tube is in a position to wash the screen itself to keep it from clogging. It contains an air-pressure release which instantly stops the spray, and, since it is a pressure sprayer, will paint with heavier materials than is possible with the ordinary spray outfit. When not in use for painting, the equipment makes a handy fire extinguisher if it is filled with the proper solution.

¶ Mixed with water, a chemical now on the market is used to make curtains, draperies and like articles flame-proof without changing their colors.

Big Loud Speaker Which Provides Entertainment for an Entire Town; It Is Audible for About Twenty Miles

RADIO HEARD TWENTY MILES WITH GIANT SPEAKER

Audible for a distance of twenty miles, a giant loud speaker, installed on the roof of a building in a suburb of Berlin, provides entertainment for the entire town. The speaker produces a sound strength equal to an orchestra of 2,000 players.

WINDOWLESS OFFICES TO END DIRT AND NOISE

Windowless office buildings probably will result as a natural development of metropolitan life, according to Robert D. Kohn, president of the American Institute of Architects. The dirt and noise of the city have become almost unbearable, and, with modern lighting and ventilating systems, it is entirely feasible to eliminate windows to exclude the outside interference. In one New York building, a series of administration offices is being built in the interior of the structure, the windowless section being completely isolated from the outdoors by sound-proof walls. Artificial lighting and ventilation take the place of the conventional windows, the offices providing quiet and comfort for the occupants.

"BRICK" VENEER HELPS IN REBUILDING HOME

Owners of old frame dwellings who desire to remodel them to resemble brick without the cost of this building material, now may obtain a brick veneer for the purpose. The veneer is produced at one-fifth the weight of ordinary brick and comes in units of twelve burned-clay bricklets one-half inch thick, made fast to a backing of insulating board with cement, making a total thickness of one inch. The units are nailed to the existing wall surface, and when pointed up, the veneer appears like real brick construction.

HEAD NET HAS WINDOW FOR CLEAR VISION

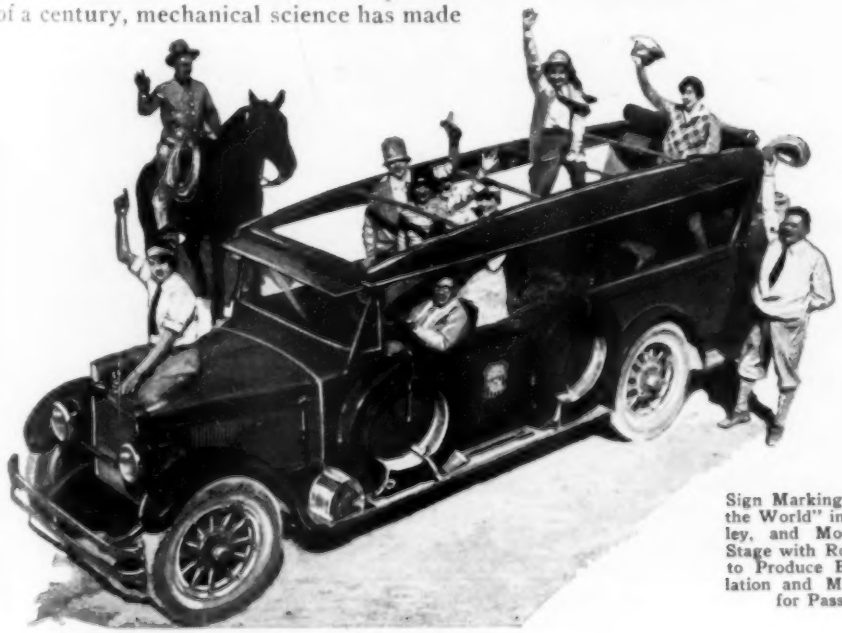
For the fisherman or other outdoor sportsman harassed by flies and mosquitoes, a head net now is available that has the additional advantage of offering clear vision because it is fitted with a window. The net, which will fit any hat, contains a section of transparent, non-breakable material.

Head Net Fitted with a Window, to Provide Protection without Obstructing the Vision

The Desert Comes Back to Life

MAN'S machinery is conquering the desert. Heat, hunger and thirst have yielded to steam, gasoline and electricity; barren wastes have become beauty spots; a month's trip in a creaking wagon has become an hour's flight in a roaring plane; the most remote mine and the loneliest ranch in the sandhills of the west talk at will with the cities; poisonous snakes and even more deadly Indians and halfbreeds have laid down the rifle for the shovel, and what was once a barrier to American advancement has become a winter resort for the tourists of the world.

From the high and wind-swept plateaus of the New Mexican desert to the depths of Death valley, 300 feet below sea level, modern hotels, well-equipped bungalow courts, homes filled with every improvement civilization has to offer are spread from the western slopes of the Rocky Mountains to the western edge of California's Sahara. In less than a quarter of a century, mechanical science has made



Sign Marking "Bottom of the World" in Death Valley, and Modern Desert Stage with Roll-Back Top to Produce Better Ventilation and More Comfort for Passengers

the desert as safe, as comfortable, and as productive as any other area in the world—even safer than the streets of some of our large cities after nightfall.

The two principal barriers nature raised to the civilization of the desert were lack of water and difficulty of transportation. Gasoline engines and electricity have overcome both. When drills were mounted on trucks propelled by gasoline motors, and driven into desert sands or rocks, it was found that the lack of water was merely superficial. A few feet under ground was and is abundant water, much of it artesian, the rest rising to a short distance from the top of the drilled hole, so that pumping became comparatively easy.

But power for the pumps was needed, so the trucks went out, drilled long lines of holes, carried wood and steel posts to the holes, set them up, and, presently, electric transmission lines appeared as if by magic, running like cobwebs across the barren lands. It is estimated that there are more than 100,000 producing wells on the American desert, at least ninety per cent of them drilled within the last fifteen years, and all contributing to the great and growing production of minerals and foodstuffs the so-called waste lands are making.

Hotels with all modern equipment, even to large swimming pools, bungalow courts, and winter resorts of every description, have followed the stages and the paved highways into the heart of the desert. Two of the most interesting hotels of this kind are in Death valley, and if you wish to spend a day or week in either of them, between November of one year and May of the next, you have to make your reservation weeks in advance. Diesel railroad cars, with a gasoline-engined branch line and large through stages, connect them with the outside world, and there is a large and well-equipped airplane landing field for flyers who care to see the hottest, deadliest bit of the American desert.

But the most phenomenal development man's mechanical ingenuity has brought to the desert is in southeastern California, where the total annual rainfall is about an inch and a half. In 1900, the white population of this Imperial valley was none, the assessed valuation of its present 526,000 irrigable acres, nothing. Today, there are more than 65,000 persons living in the valley; the assessed valuation is more than $55,000,000, while its agricultural, dairy and poultry products sold, in 1929, for $62,000,000. Machine-dug canals bring water from the Colorado river by gravity to these lands. Tractor cultivation has converted the sand and clay and silt into 4,769 farms, whose crops are hauled by trucks to packing houses, where they are sorted, classified, cleaned and packed

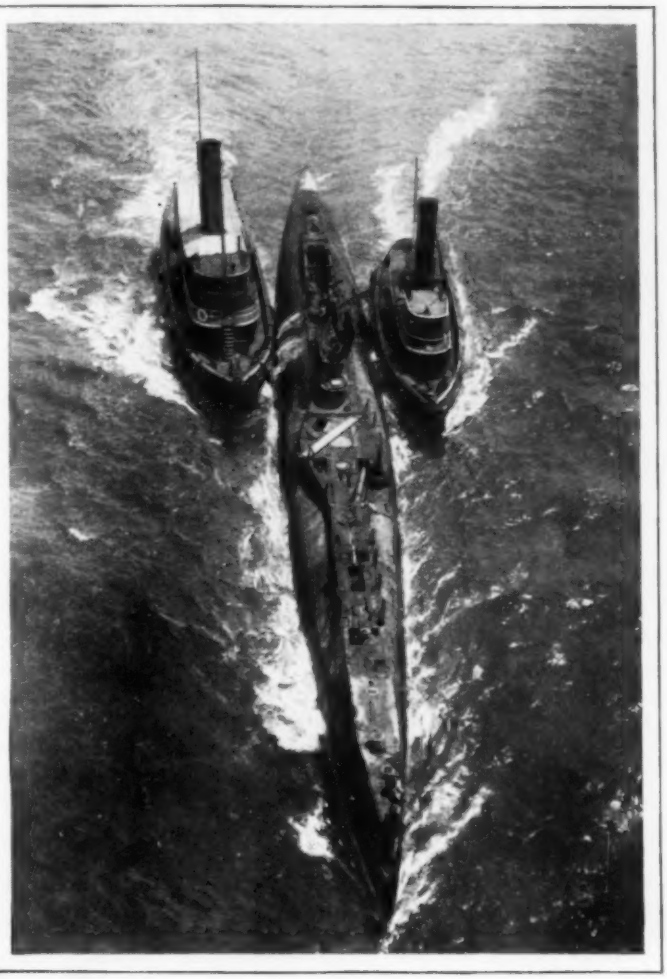
This Comfortable Hotel Offers Travelers Luxuries of a City Inn, Although It Stands in Death Valley Desert at the Mouth of Skull Canyon

by machinery, and sent in refrigerated express cars and motor trucks to markets all over the United States.

New and valuable mineral and agricultural products are coming from the desert under the reign of the machine there. Borax, which, in the days of the twenty-mule teams, cost nearly ten cents a pound to produce and deliver to market, is now being mined with shovels and transported in tractor and truck-drawn trailers, so that it can be retailed for less. Pottery clays are being shoveled out by Diesel-driven scoops, and hauled by truck to manufactories on the Pacific coast. Cost of mining and transporting these clays was prohibitive until the oil and gasoline engine entered the desert.

Semi-precious gems—turquoise, tourmaline rock crystal, topaz, beryl, and the like—hidden in the great burned-over wastes of volcanic rock, are being found by prospectors driving "flivvers." These men cover so much greater areas than they could do with burros or mules that the difference in cost between gasoline and hay is more than balanced by the discoveries made. Not less than four parties of gem experts are motoring in as many sections of the American desert in the belief that there are diamond deposits.

From seats in cabin planes, other prospectors search the desert hills for more visible deposits of copper, gypsum, and other ores and salines, with cameras to record for them the terrain over which they pass. With such planes, more territory can be prospected in a week than could be covered in six months by the old-time prospector on foot or on mule back, while hidden deposits are more easily seen.



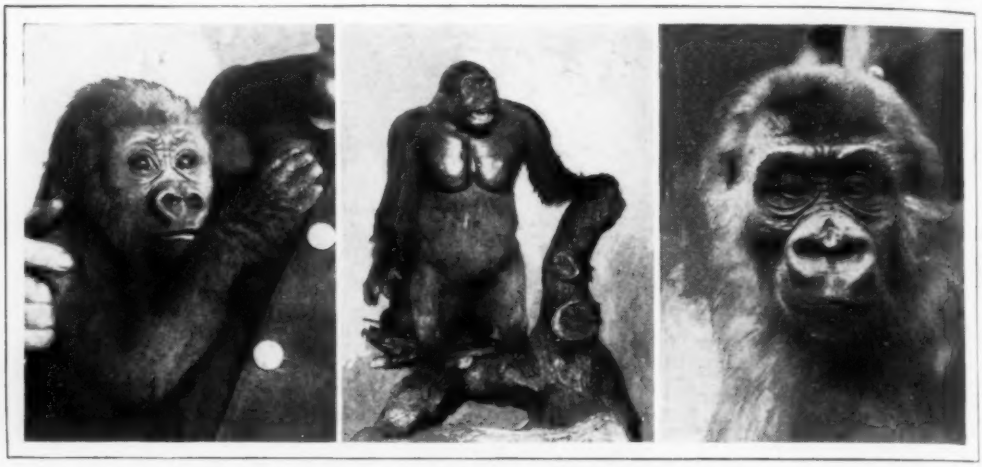
The Submarine "S-51" on Way to the Junk Pile; a Crew of Over Thirty Perished When the Boat Sank off the Rhode Island Coast

FAMOUS SUB MAKES LAST TRIP TO THE JUNK PILE

Two tugs and a battered submarine formed a water funeral procession under the Brooklyn bridge recently, when the undersea craft, the famous "S-51," was taken on its last journey with its destination the junk pile. The "S-51" is the ill-fated boat that carried more than thirty of her crew to their death when she sank off Block island, R. I., five years ago. She was raised after a long period of suspense.

¶Luminous programs, readable in the dark, have been introduced by a London theater.

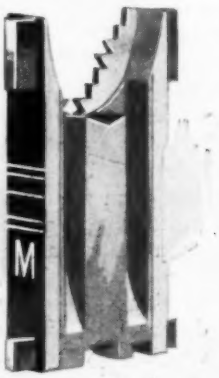
HUNTER TELLS HOW GORILLAS ARE CAPTURED



Specimens of Gorillas That Have Been Taken Captive, the Center One Being a Mounted Museum Exhibit; These Animals Are Unable to Survive Captivity More Than Four Years

While a good lion cub, in perfect health, may be purchased for as little as $150, a two-year-old gorilla is still worth more than $5,000. For the first time there are five strapping young gorillas in captivity, Julius Buck, wild animal collector and veteran of thirty-five expeditions into the jungles for rare beasts and birds, recently having returned with a new specimen. To be sure, a rhinoceros may be worth as high as $9,000, but when it is realized that no gorilla has lived more than four years in captivity, and that the hay eaters, such as the rhino, are long-lived, it will be seen that the gorilla is a particularly expensive beast for the menagerie. No animal has been more misunderstood, and none has suffered more at the hands of fiction writers than the gorilla. It has ever been an animal of mystery and little is known of its habits—in fact, until 1903, only one live specimen had been seen in the United States. No less an authority than Carl Akeley, the scientist and explorer, stated that the gorilla is not vicious, and not being wary, has been the prey of hunters. The method of capturing them alive is most interesting. A mother with a baby is singled out of a herd and followed from a distance for days. Finally the mother is wounded by a poison arrow shot by a native—care being taken that she is not instantly killed, but merely wounded. The herd is then followed, and the mother, becoming weaker from her wound, falls farther behind until finally she drops from exhaustion and the baby is then taken from her. Now the real troubles of the animal collector begin, because, like as not, the baby will refuse to eat and will die. No full-grown gorilla has ever been raised, or captured alive, and guesses can only be made of its strength. Compared with man, the animal is much stronger and heavier.

MATRIX WITH WHITE LETTERING IS MORE EASILY READ



Through a special process of chemical treatment, white lettering now is being used on matrices to aid the linotype operator or compositor in spacing and to give better visibility. The matrix, or piece of brass which stamps the letter impression in type metal in printing, ordinarily has the letter stamped in its face, but this is not easily seen when the matrix becomes dirty. By a chemical process the brass face has been turned black and the lettering in contrasting color set in it.

VACUUM CLEANER FOR GRIT SPEEDS VALVE GRINDING

To facilitate the difficult task of cleaning up an automobile engine after a valve-grinding job, a grit remover, somewhat like a vacuum cleaner, now is being employed. It fits over and around the grinder body and is moved from one cylinder to another with the grinder. With this equipment, the motor is clean and ready for the fitting of pistons when the grinding is finished, thus saving an hour or more on each job. Particles of dirt and grit are collected in a bag which, with a small electric motor, is mounted on two rubber-covered brackets, hanging on the car door. With the addition of a few attachments, the apparatus can be adapted to cleaning car interiors and rugs.

Portable Cylinder Grinder and Grit Remover, the Latter Operating Also as a Vacuum Cleaner

Sea Turtle Weighing 750 Pounds, Which Was Lassoed as It Plunged through the Water, and Landed with Rope after Struggle

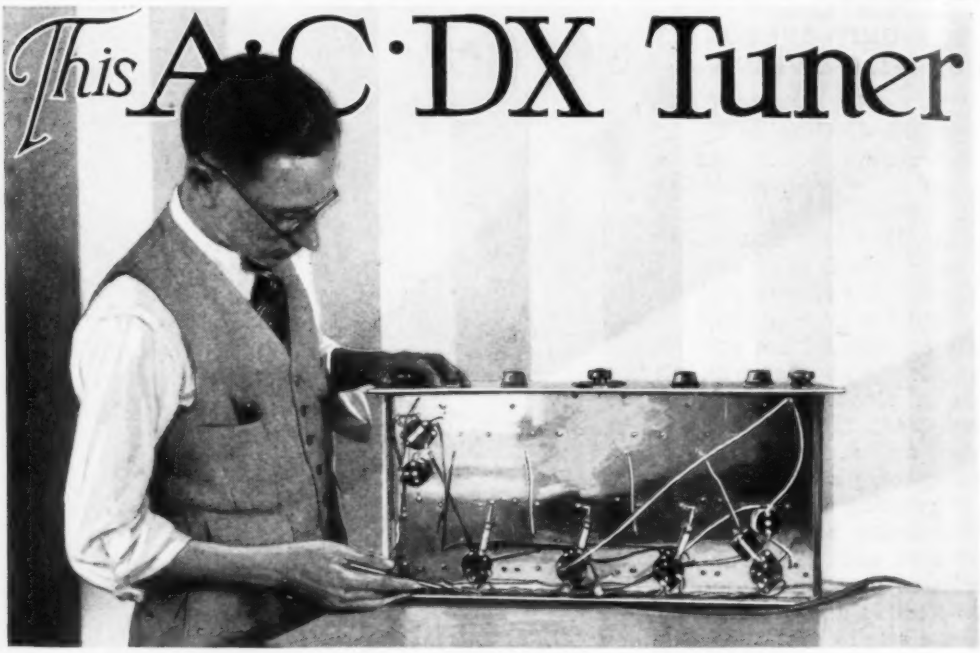
TURTLE CAUGHT WITH A LASSO WEIGHS THIRD OF TON

Catching a sea turtle with a lasso was the difficult feat performed recently by the skipper of a vessel on the Pacific coast. The turtle, which weighed 750 pounds, was roped as it plunged through the waves, and was landed with the lasso after it had worn itself out in struggling.

ADD OFFENSIVE ODOR TO GAS TO WARN OF LEAKS

Engineers of the bureau of mines have developed a chemical of very offensive odor which they urge be added in small quantities to odorless illuminating and fuel gases so that leaks in pipes can be detected instantly. The substance is ethyl mercaptan, an organic sulphur compound, which has such a disagreeable odor that only one-hundredth pound in a million cubic feet of gas is necessary to warn. Eight pounds per million feet of gas would warn of slow leaks in homes, and forty pounds would allow inspectors to detect leaks in mains. Most manufactured gas has an odor that can be detected, but natural gas is virtually odorless.

This A·C·DX Tuner



THE RECEIVER described in this article has been designed for a very high order of selectivity and sensitivity, with a minimum number of controls to do the job correctly. The circuit, shown in Fig. 2, gives maximum gain without introducing any of the more common losses, and an antenna of almost any length may be used, without changing the tuning.

The chassis is made of 20-oz. burnished and lacquered copper, and each stage is individually shielded by a copper can. Templates for building the chassis and cans are shown in Figs. 2 and 3. The base layout, Fig. 2, gives the location of the holes drilled in the top, as measured from the edge of the base, and the over-all size is for the top only. The metal sheet from which the base is made is actually 1½ in. larger all around, a 1½-in. square being cut out of each corner and the ends and sides bent down to raise the base 1½ in.

The tuning condensers are mounted on brass bushings, $^{23}/_{32}$ in. high and ½ in. in diameter. These condensers are furnished with two mounting holes on the base, which are tapped to take 8-32 brass machine screws, 1¼ in long. When mounted

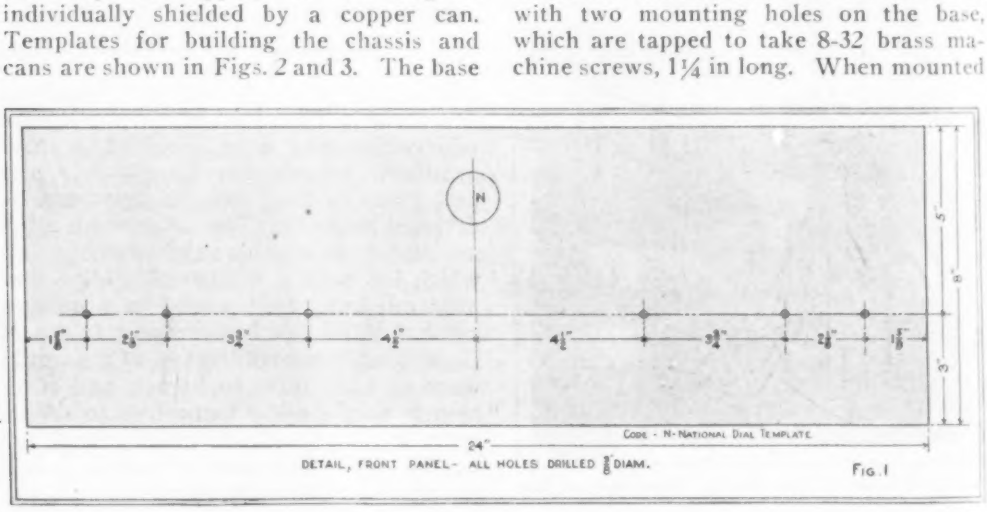


FIG. 1

is Highly Selective

by J. O. Barnes

in this manner, the metal base panel serves as the connection to ground and negative B, which are common to all the variable condenser rotors, both tuning and trimmer types. The latter are mounted on a standard 1 by 1-in. brass bracket, and are screwed directly to the metal base.

The battery cable has seven conductors, four being used to supply the filament of the heater-type tubes, two in parallel for each side; see lower photo on page 650. The three remaining leads furnish the plate voltages to the tuner.

Leads for varying the coil taps are made of insulated flexible wires, with a split lug on the coil end to be inserted under the various machine screws on the coil bases. The entire metal base and the shields must be kept at ground potential. This makes it necessary to guard against short circuits when running the wires through the metal base, as shown in upper photo on page 650. Fig. 1 shows the template for drilling the front panel; this panel is of ⅛-in. bakelite, and the template for the dial holes, indicated at N, comes with the dial.

The filament transformer, which supplies all the tubes in the tuner at the neces-

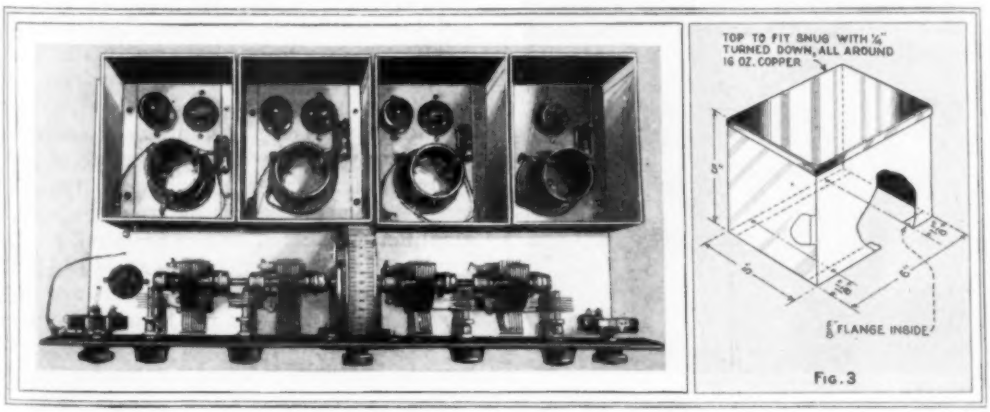


FIG. 3

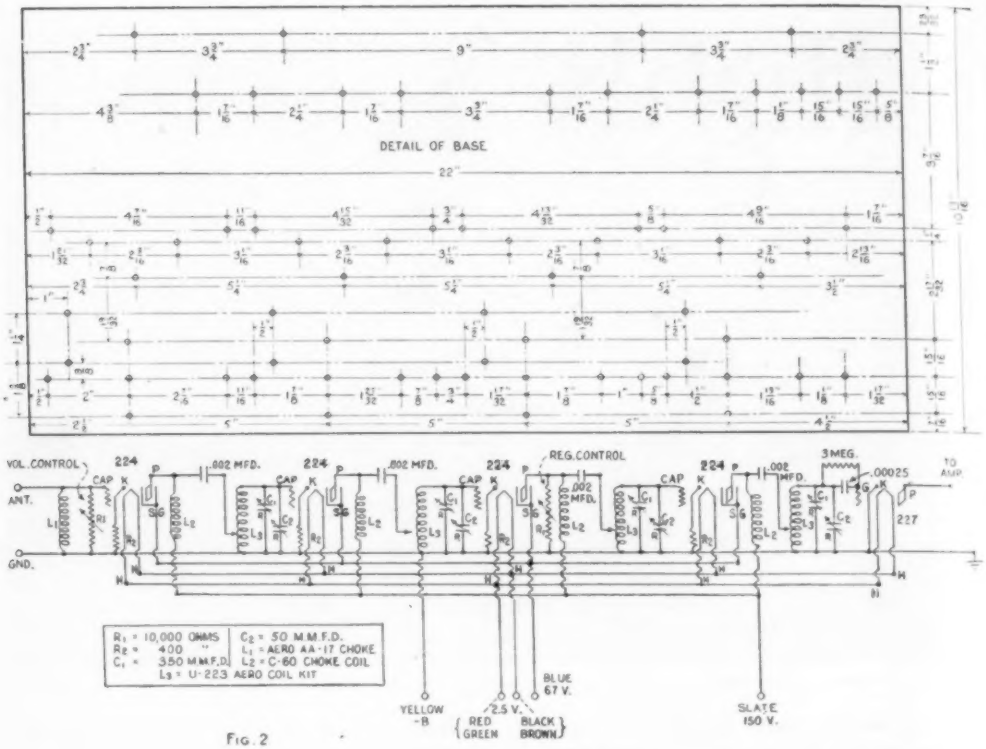
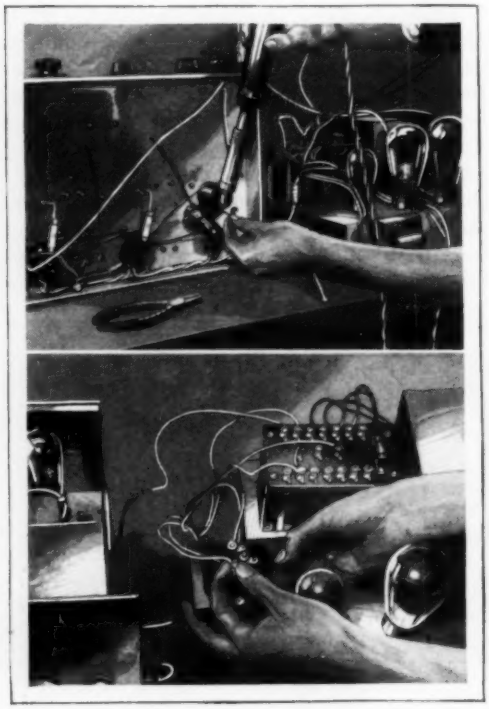


FIG. 2



sary 2.5 volts a.c. and required amperage, is used separately, making it possible to employ any type of power amplifier desired with this independent tuner unit. The output from the plate of the detector tube to the input of the audio amplifier may be taken from an adapter, as shown at the left in Fig. 4, or a lead may be soldered directly to the plate terminal of the detector socket and taken to an insulated binding post mounted at a convenient point on the base panel. The antenna post must be carefully insulated from the base, but the ground post is mounted directly.

The power amplifier shown in the head of the article is a type that furnishes all the B-voltage for the tuner as well as for the audio system. It contains a stage of 227-audio which feeds into a stage of 250.

Dynamic speakers of the d.c. type or magnetic speakers can be used with this amplifier. A sketch of the terminal board connected to supply this tuner and the field winding of a 90-volt d.c. dynamic speaker is shown. Directions for other combinations are available as well as enlarged set layouts, material list and circuit diagrams.

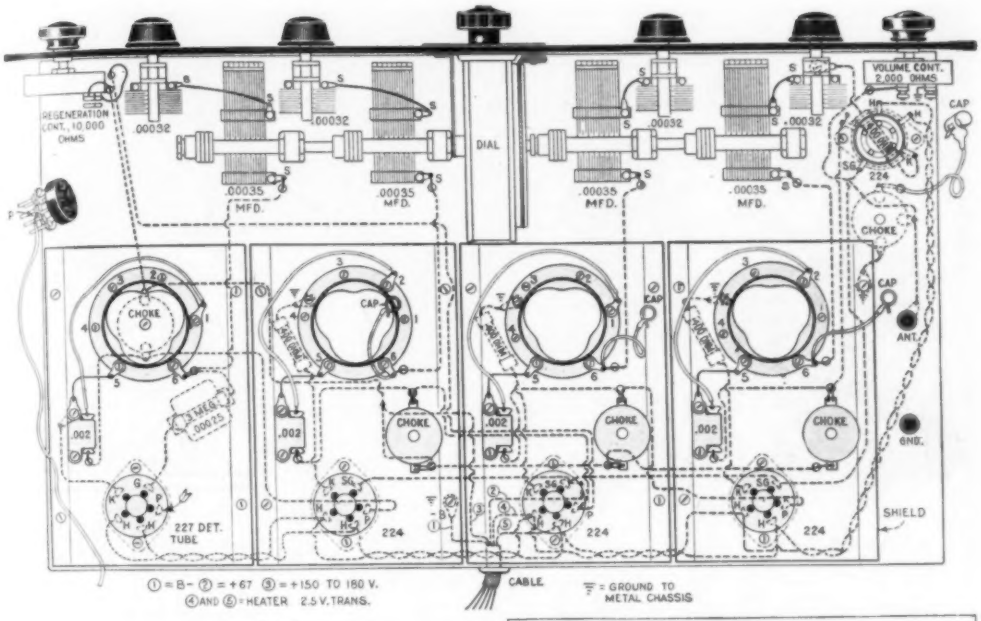
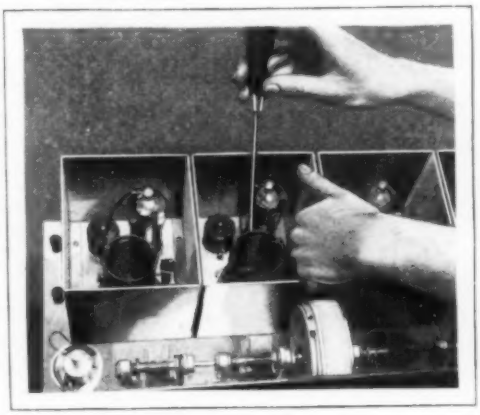
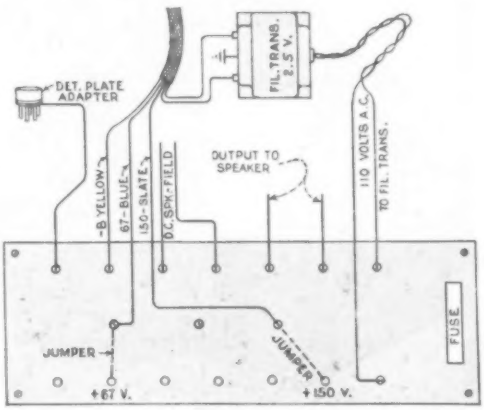


FIG 4

To adjust and tune the set, connect all coils on tap No. 2, and tune in a fairly weak signal, then, when the set is oscillating, adjust the trimming condensers on the front panel until maximum volume is obtained. Next work the regeneration control until the set is brought out of oscillation. If the set does not oscillate freely, change the tap on the detector coil to No. 3. If, after tuning in several stations, the set is too broad, move the taps on the r.f. coils down to No. 1. See photo on this page. The use of care in adjusting the taps on the coils and lining up the trimming condensers is important. When they are once lined up, the operator can control sensitivity with the trimmers, to suit either local or distant reception.





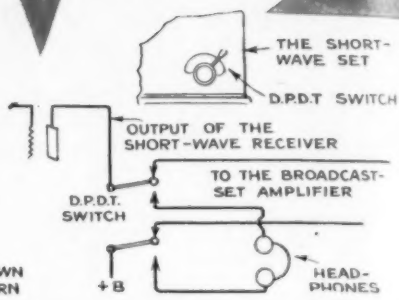
AMPLIFIER TERMINAL BOARD

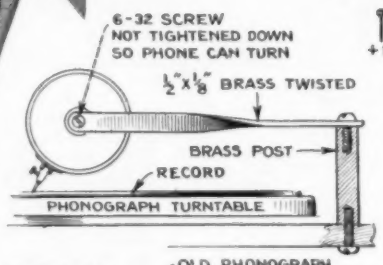
Further Data on Locating Hidden Metals

Owing to the interest of our readers in the article, entitled "It's Easy to Locate Hidden Metals," which appeared in the May, 1930, issue, further experiments were conducted with the exploring device in an effort to make it more sensitive. It was found that the oscillator was too stable, or limited as to sensitivity. This was easily remedied by substituting a .00035-mfd. variable condenser for the .001-mfd.

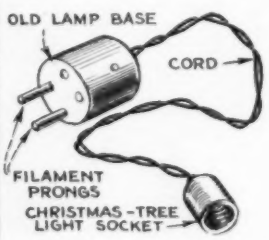
Helpful Hints from the

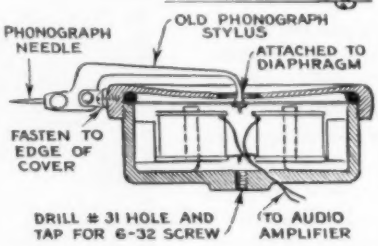
A Piece of Cardboard under the Radio Console Will Compensate for Floor-Level Imperfections; Right, a Homemade Phonograph Pick-Up for the Radio Amplifier Made from a 1,500-Ohm Headphone and an Old Phonograph Stylus; the Sketches Are Self-Explanatory



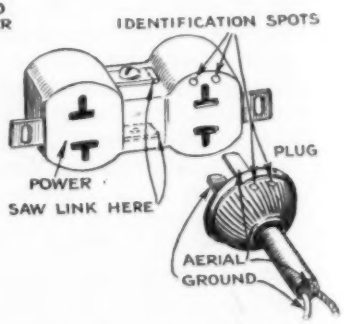


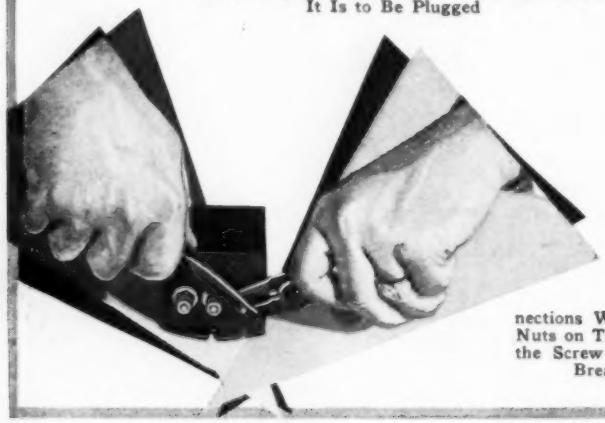
Owners of Short-Wave Sets Usually Wish to Use the Amplifier of the Broadcast Receiver to Obtain Volume on Short-Wave Programs; When Tuning in These Short-Wave Stations Squeals Are Rather Difficult to Avoid, So One Experimenter Solved the Problem with a D.P.D.T. Switch Used to Connect a Pair of Headphones to the Output of the Short-Wave Set for Tuning Purposes, and When the Short-Wave Station Is Properly Tuned In, It Is Easy to Switch to the Broadcast Amplifier and Speaker




PHONOGRAPH NEEDLE
OLD PHONOGRAPH STYLUS
ATTACHED TO DIAPHRAGM
FASTEN TO EDGE OF COVER
DRILL #31 HOLE AND TAP FOR 6-32 SCREW
TO AUDIO AMPLIFIER

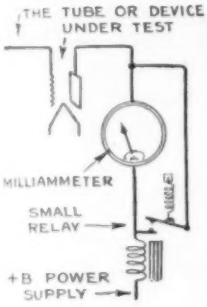
Left, Handy Plug-In Test Lamp for the Experimenter; the Lamp Used Must Correspond to the Voltage Employed in the Set Socket into Which It Is to Be Plugged

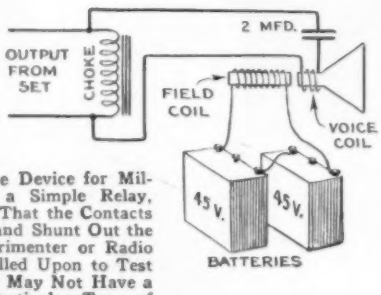




Above, Combination for Power, Antenna and Ground Connections, Made from an Ordinary Double Baseboard Receptacle; Mark Plug and Outlet so as Not to Confuse Antenna Connections When Removed; Left, When Tightening Nuts on Transformer Terminals, Use Pliers to Hold the Screw While Turning the Nut; This Prevents Breaking Soldered Wire Connections

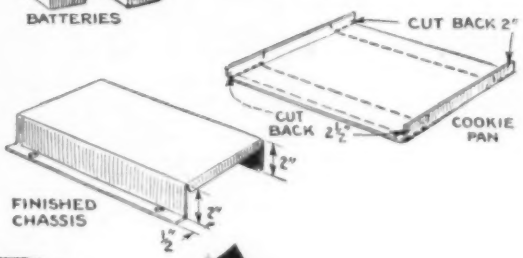
and Kinks Radio Lab.

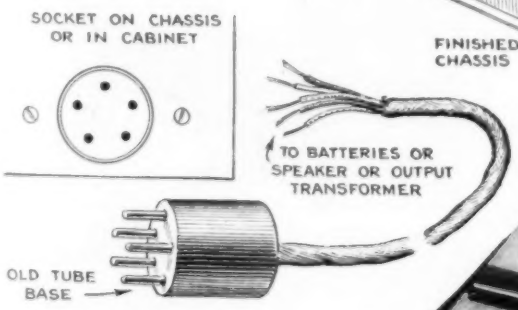


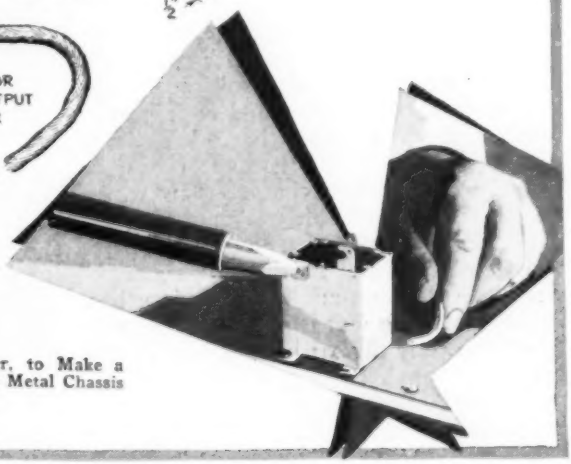


Upper Left, a Protective Device for Milliammeters Consists of a Simple Relay, Connected as Shown, so That the Contacts Will Close on Overload and Shunt Out the Meter; Right, the Experimenter or Radio Handy Man Who Is Called Upon to Test a D.C. Dynamic Speaker May Not Have a Receiver Using That Particular Type of Speaker; in Such Cases the Speaker May Be Operated by Using B-Batteries, Connected to Supply 90 Volts to the Field Winding

A Voltmeter, Reading 0-150, May Be Used to Measure High-Voltage Outputs; Add Readings, Negative to 90; 90 to 180 and 180 to Maximum, and Total Will Be Maximum Voltage; Below, Simple Homemade Metal Chassis







Above, a Convenient Method of Bringing Leads to Receivers; an Old 5-Prong Tube Base and Socket, Prepared and Mounted as Shown, Make Quick Connections; Right, Soldering Lug of a By-Pass Condenser to the Metal Container, to Make a Short and Efficient Ground Connection to the Metal Chassis upon Which It Is Mounted

From 15 to 195 Plug-In

PART II

TUNING instructions help the beginner in the operation of a short-wave receiver, but skillful tuning comes only with practice. A short-wave receiver is not tuned like a broadcast receiver, for example; the most important control knob on the panel is the one that controls the regenerative action of the detector. The detector should be kept in a continual state of oscillation by turning the "volume" or regeneration-control knob back and forth as the tuning dial is turned a fraction of a degree at a time. When the carrier wave of a short-wave station is picked up, there is a characteristic whistle. If the signal is fairly strong, you can back off the regeneration control until the whistle disappears. In case the signal is weak, keep the circuit in oscillation, but move the tuning dial so that the set oscillates at exactly the same frequency as the incoming signal. This is known as zero-beat tuning, and the whistle disappears, owing to the fact that there is no heterodyning action when the receiver is in this condition. This method is only to be employed on weak signals that cannot be otherwise received. Frequently weak signals brought in by the zero-beat method will gradually increase in strength to a point where the detector

can be thrown out of oscillation to advantage.

The 20, 40, 80 and 160-meter coils can be thrown in and out of the circuit by turning the knob at the left while the receiver is in operation. It will be found that the 20-meter coil is the best choice for morning and early afternoon, its efficiency dropping off at about 5:00 p. m., whereupon the 40-meter coil is good until about 9:30 and the 80-meter coil from then until daybreak, when again the 20-

Meters Without Coils

by Frank L. Brittin

meter coil will be the most effective. This schedule refers to DX-reception and, of course, is not intended to be a set rule, as stations will be picked up at almost any time with either of the three coils. The 160-meter coil will be found most useful for receiving television signals; all of these coils overlap so that the wave bands from 15 to 195 meters are thoroughly covered by them.

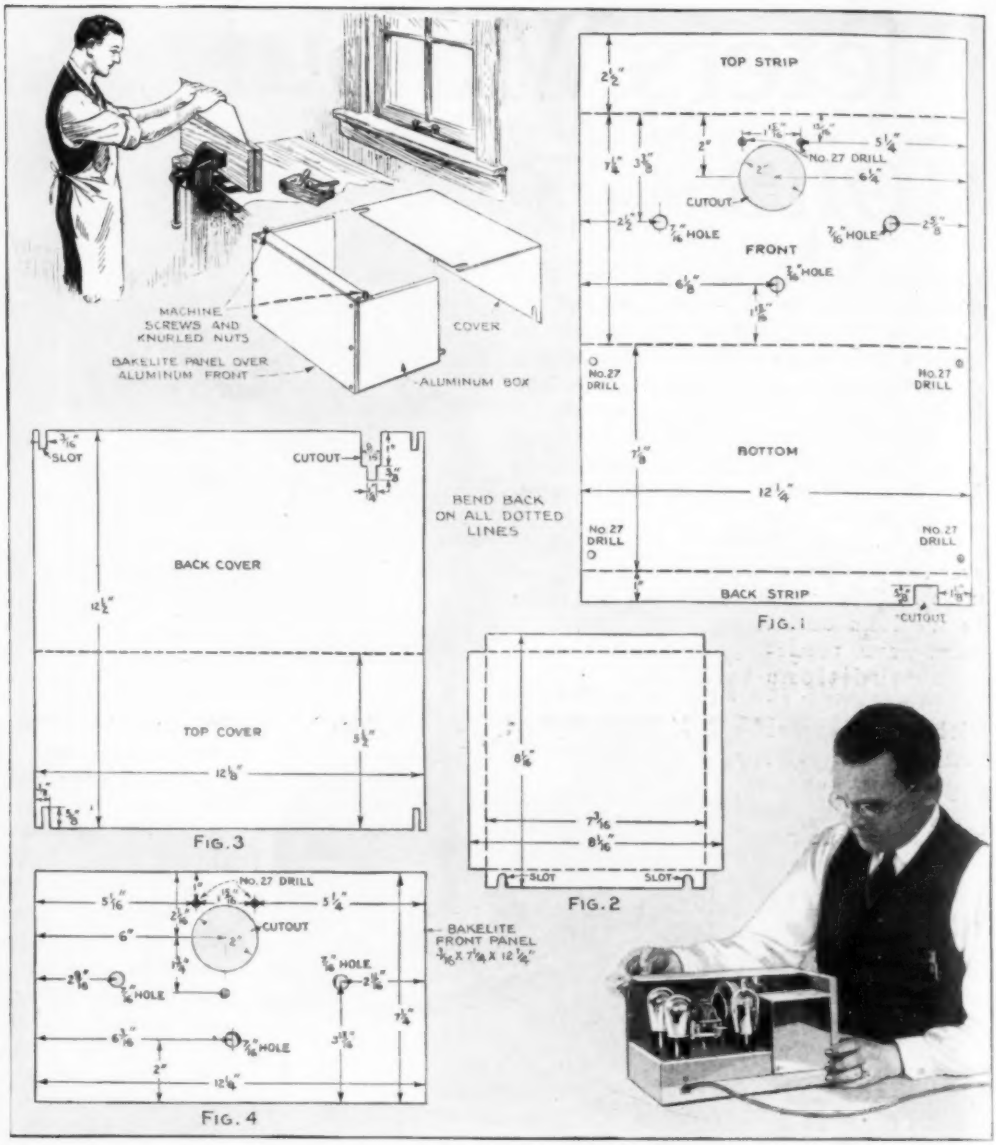
Complete lists of short-wave stations all over the world are available and many of these stations are broadcasting on voice as well as code. Short-wave receiving conditions change quickly without apparent reason; therefore, if you pick up a foreign station one night and fail to get it again for several nights, do not feel discouraged.

The following short-wave stations were logged with this set within a few hours, at our testing laboratory in Chicago.

Four stations in the seventh district, four in the fourth, two in the fifth, six in the sixth, one in the second, four in the first, and four in the ninth district; in addition, one eighth-district station on phone and WGY on trans-oceanic phone. Two of the ninth-district stations were also on phone, but no effort was made to tune in foreign stations owing to unfavorable atmospheric conditions during this test.

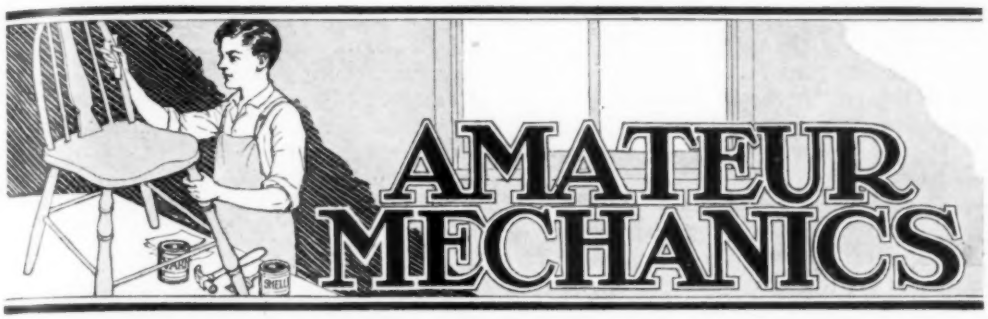
The homemade metal cabinet with the bakelite front panel, illustrated herewith by photos and templates, is very simple to construct. The material used for this box and removable cover is 1/32-in. sheet aluminum. Fig. 1 shows the template for the front and bottom with the overlapping back and top strips all in one piece. Make the large cut-out with an expansion cutter, and drill all holes before attempting to make the bends on the dotted lines. This also applies to Figs. 2 and 3, and if the phone jack is to be mounted at the rear of the set chassis, an additional cut-out must be made in the back strip of Fig. 1, to accommodate the phone plug, which must not touch the metal chassis or the metal cabinet. Full-size working templates are available for those who wish them.

When the instrument controls on the front panel are in position, they hold the panel in place and no further machine screws are necessary. The sketch in the upper right-hand corner on page 656 shows the simple method used for bending



the aluminum sheets to form the cabinet. The lower photo on page 654 shows the method of bending and shaping the edges of the end covers. This is done by clamping a short piece of 2 by 4-in. wood in a vise and bending the edges over with another short piece of wood, after which a few light taps with a hammer, as shown, will make a neat sharp bend. The completed cabinet may be given an attractive finish with one of the quick air-drying black crackle lacquers, as shown.

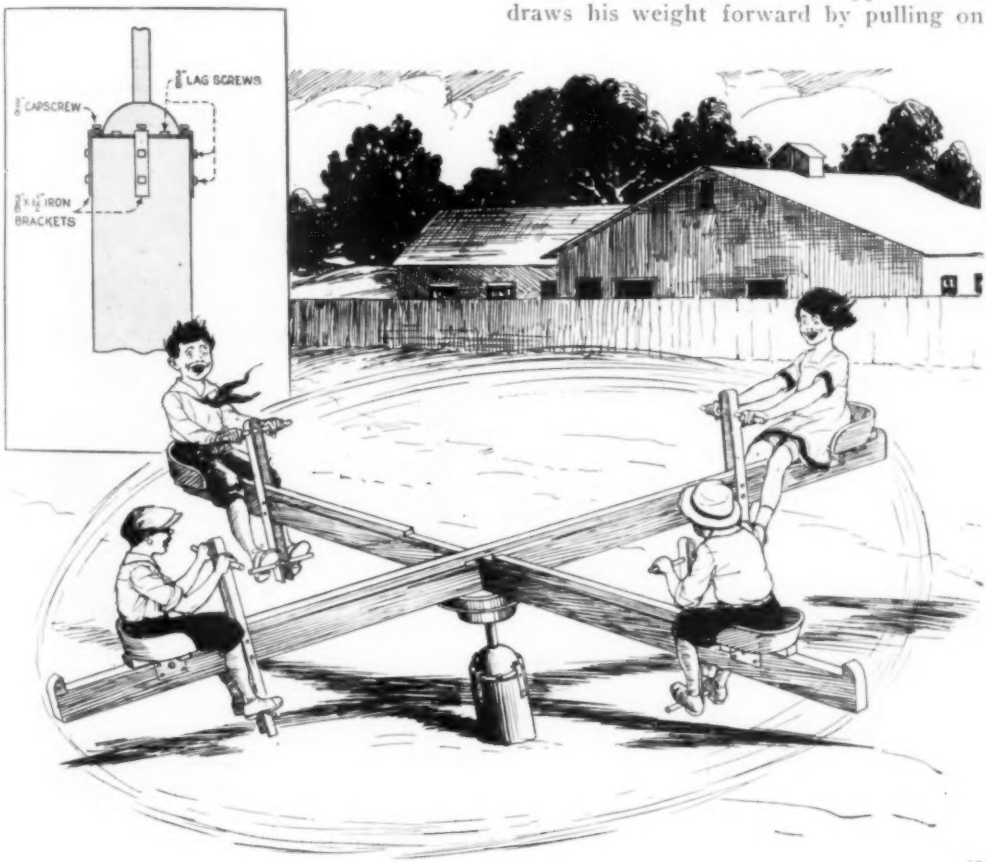
The cabinet is now ready for the bakelite front panel and this panel may be engraved and decorated to suit the builder; the engraved border was done with a ruler and icepick, as shown in the insert photo on page 655. Wet the engraved lines and rub in white chalk. Mount the bakelite panel on the front of the cabinet by means of bushings and locknuts that come with the coil unit and variable resistance, then mount the escutcheon for the drum dial.



How to Build a "Wabble-Go-Round"

By RICHARD COLE

HERE is a novel amusement device which can be made easily and cheaply by any handy man or boy—a "Wabble-Go-Round." The operation of this novel device can be visualized by referring to the illustration on this page. The wabble-go-round is similar to a merry-go-round, except that its axis is tilted 15°, so that the riders are alternately raised and lowered as the device turns. This makes possible a very simple means of auto-operation. When one of the arms reaches the top of its swing, the rider quickly forces his weight back by pushing against the foot-rests, while the rider at the opposite end draws his weight forward by pulling on



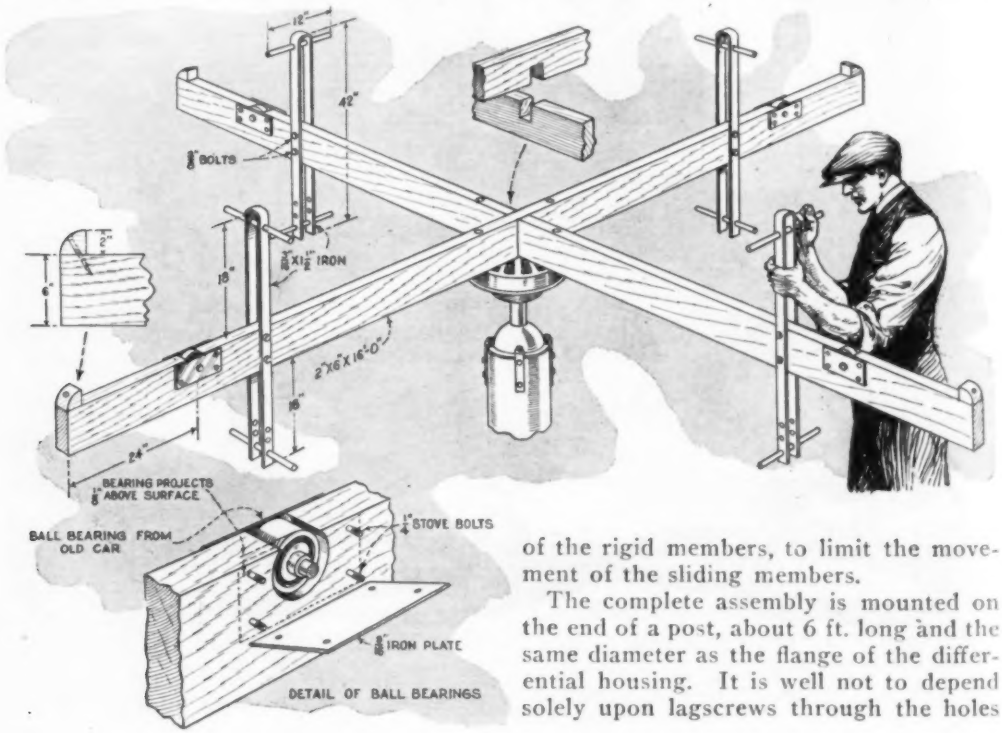
the handholds. This brings the center of gravity above the center line of the axis of revolution, and the rider at the top swings down to the bottom. Again, the weight of the riders is shifted, and the wabble-go-round is kept turning continuously.

The device is free from all mechanical complications, and all the material for its building can usually be bought for less than $5. The chief requisite is one-half of a full-floating-type rear-axle assembly from a junked car. This type was used extensively on heavy cars and trucks a few years back, and many of them can be picked up for a song at an auto "graveyard." The differential gears—even the driving axle itself—are not needed in building the wabble-go-round; only the housing, wheel and wheel bearings. There is little "used-part" demand for housing and wheels, and they can be found in the junk pile and can be bought at junk price. It might be well to mention that a full-floating axle assembly is one in which the wheel is supported and turns on the housing; it is not rigid on the driving axle.

After the axle assembly has been obtained, the next operation is to prepare and mount the rigid radial members. Two 16-ft. lengths of 2 by 6-in. wood of good quality are notched at the middle and interlocked at right angles. They are then fastened to the side of the wheel with long bolts through the rim. The bolt heads must be countersunk so as to leave no projection on the top face of the 2 by 6-in. pieces.

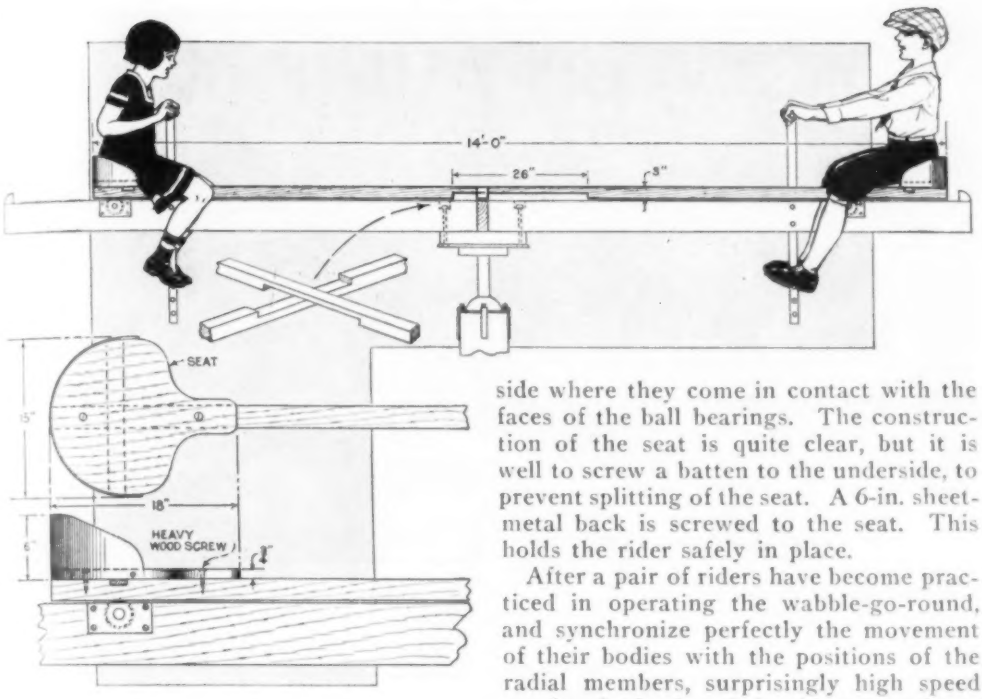
Brackets for the footrests and handholds are made of 3/16 by 1½-in. iron or steel, the footrests and handholds themselves being made of ½-in. round rod. A hole for a 5/32-in. cotter pin is drilled in the middle of the rod, to prevent it from coming out. Three or more holes are drilled through the bracket at the bottom, so that the footrests can be adjusted for different leg lengths.

Movable radial members slide on the top surface of the rigid members; so, to make the movement as frictionless as possible, old ball bearings, obtained from the auto junk yard, are set into the rigid members, with the outer face of the bearings projecting ⅛ in. above the surface. The detail drawing will make the installation of these bearings quite obvious. Stop blocks are screwed to the extreme ends



of the rigid members, to limit the movement of the sliding members.

The complete assembly is mounted on the end of a post, about 6 ft. long and the same diameter as the flange of the differential housing. It is well not to depend solely upon lagscrews through the holes



in the flange, as these must be driven into the end wood, so four angle brackets of ⅛ by 1¼-in. iron are lagscrewed to the side of the post, and the flange is clamped with ⅜-in. capscrews at the top. If a cylindrical post is not readily available, although a section of an old telephone pole can usually be procured, a square box can be made of 1-in. lumber and filled with sand or concrete, when it will serve equally well.

The post must be set very firmly in the ground at an angle of 15°, and care should be taken that the arms, at the lowest point of their swing, clear the ground amply. As a safety precaution, this clearance should be sufficient for the moving parts to pass freely over anyone lying on the ground, otherwise, if a rider were to fall off, he might be severely pinched. It is well also to set the post in concrete, but if this is not readily at hand, old bricks, rocks and soil should be tamped firmly around the post.

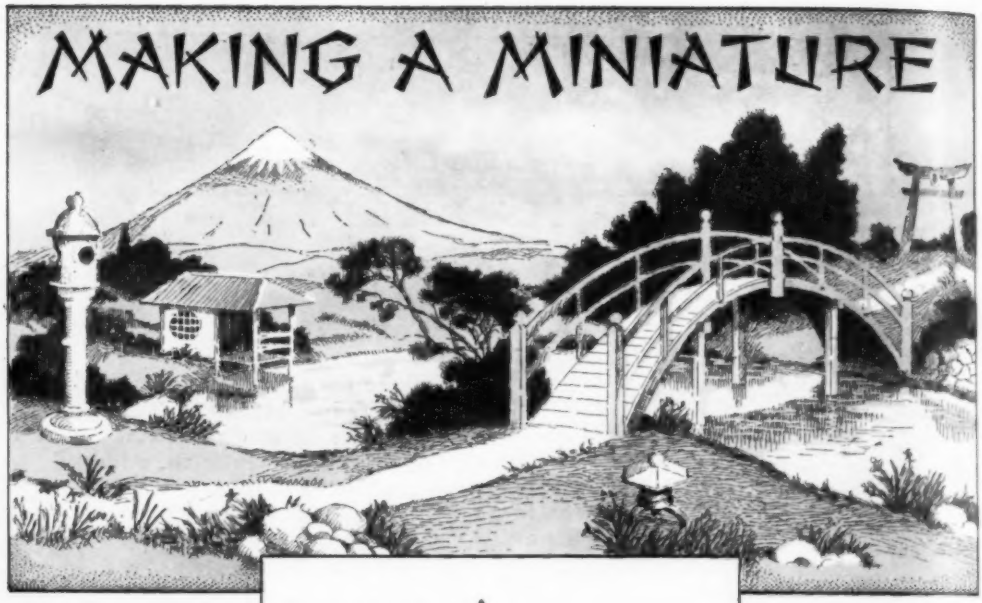
The final operation is to make the sliding radial members. It is recommended that these be made of hardwood, oak preferred. If soft wood is used, sheet-metal plates should be fastened to the underside where they come in contact with the faces of the ball bearings. The construction of the seat is quite clear, but it is well to screw a batten to the underside, to prevent splitting of the seat. A 6-in. sheet-metal back is screwed to the seat. This holds the rider safely in place.

After a pair of riders have become practiced in operating the wabble-go-round, and synchronize perfectly the movement of their bodies with the positions of the radial members, surprisingly high speed can be obtained, and the riders experience some thrilling sensations, not only the ordinary merry-go-round reaction, but the sensation of the quick starting and stopping of an elevator as well. Too prolonged a ride should not be taken, for fear of dizziness that might result in an accident. To stop the wabble-go-round, it is necessary only to relax and let the bodily weight shift of itself with the rotation of the device.

Shellac for Insulating Wire

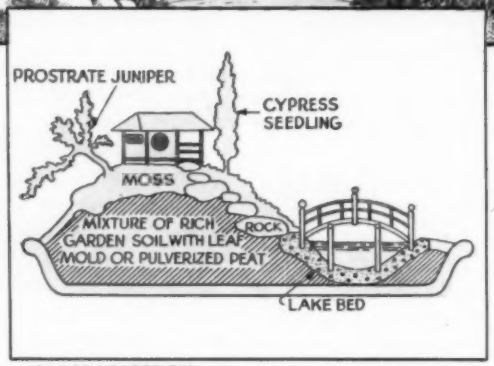
When the experimenter needs a length of wire with thin insulation and has no enameled wire on hand, a temporary substitute can be made by using shellac. If the wire is not too long, it can be coiled and dipped. If it is of considerable length, it should be wound on a spool and drawn through the shellac, the surplus being wiped off with a cloth. It is usually best to give the wire three or four applications, permitting each coat to dry thoroughly before putting on the next. In this way, the wire will be sufficiently insulated, but it should not be used for carrying an excessive amount of current.—Cecil Metzger, Lincoln, Nebr.

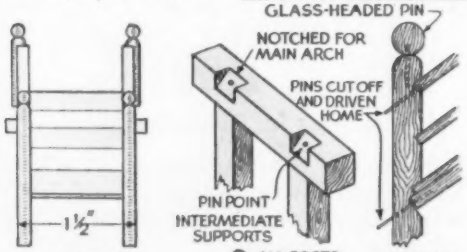
MAKING A MINIATURE

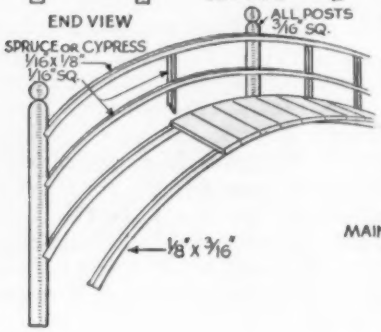


IN OLD JAPAN land is so valuable that the nature-loving Japanese have developed a style of garden especially adapted to limited space. Many of them, complete in every detail, with pool, arched bridge, stone lamps and shrubs, would scarcely cover an average kitchen table, yet they constitute the entire backyard.

The picturesque features of these little gardens lend themselves admirably to construction in miniature, and can be built up on trays or bowls from 6 to 24 in. in diameter. All the necessary materials are available in practically every section of the country, with the possible exception of moss in the







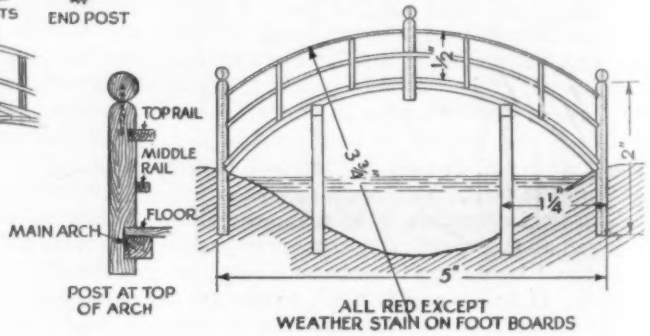


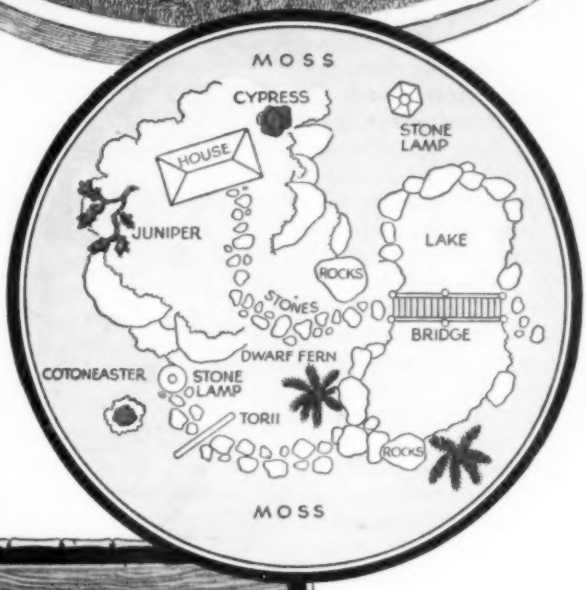
Fig. 1, Above, Shows a Section of the Garden, and How the Soil Is Banked; Fig. 2, Left, Gives Details of the Arched Bridge

JAPANESE GARDEN

by Bob Hartley

southwestern states, and model-airplane cement in rural communities. However, the latter can be purchased by mail from model-supply houses. It is excellent for the purpose, as it is waterproof, and will not loosen from the moisture of the garden as glue might. Besides, it takes the place of pins or nails in very thin wood, and has a grip like a snapping turtle.

To start with your garden, first select the size of base you wish. A 20-in. diameter is good for a table centerpiece and offers ample space for the many features of the "landscape." Japanned serving trays can be bought for about 60 cents and are entirely satisfactory, although a vitrified bird bath is more ornamental. The original shown in the photos was built up on one which cost $3. It is of a lettuce-green tint and is exceptionally attractive.



Sift a thin layer of rich garden soil over the bottom, bank it up around the site for the lake and fill around this, to the level of the rim, with a mixture of soil and leaf mold, or pulverized peat, as in Fig. 1. Any other potting soil suited to shrubs will be satisfactory.

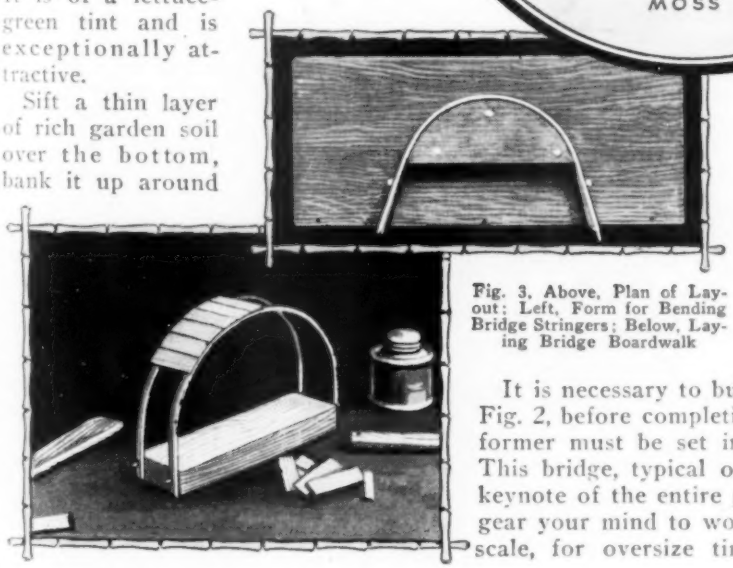
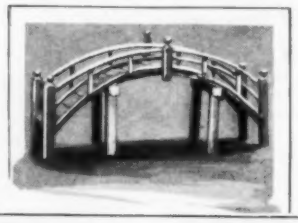


Fig. 3. Above, Plan of Layout; Left, Form for Bending Bridge Stringers; Below, Laying Bridge Boardwalk

It is necessary to build the arched bridge, Fig. 2, before completing the lake, since the former must be set in the cement bottom. This bridge, typical of Japan, is really the keynote of the entire garden, and you must gear your mind to working on a very small scale, for oversize timbers will give it a

clumsy appearance. Spruce or cypress will do for the curved pieces. Soak the straight sticks in water for an hour and then bend them over a form, as shown in one of the photos, to dry thoroughly in the sun. When they have set to shape, tack the two main arches to a block of wood, about 6 in. long, with small brads, and put on the footboards. These can be cut from berry boxes or other thin wood. Apply cement liberally on the underside, but keep the top sides of the boards clean, as these are to be stained a weathered tone. You will note that the bridge is 5 in. long at the base of the arch, so carry the footboards down to these points. When the cement has set—half an hour is sufficient time—saw off the ends of the arches with a fine-tooth hacksaw.



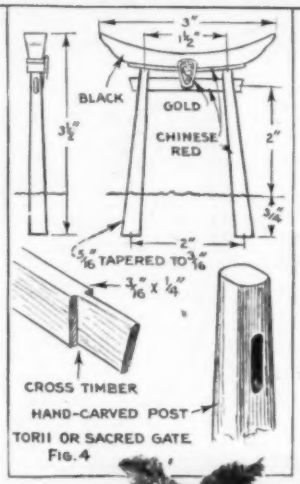
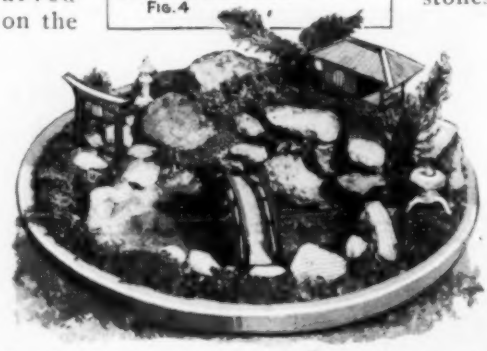


FIG. 4

Install the four end posts next. These are made of 3/16-in. square white pine, notched as shown, to receive the ends of the curved pieces, and rounded on the top end. Large glass-headed pins, with most of the points cut off, are pushed into the tops of all the posts. Save the pin points and use them to secure the posts to the ends of the main arches and top rails, and reinforce the joints with cement. Install the short posts at the top of the arch before putting on the top and middle rail. It may be necessary to lay the bridge on its side on a board, with large nails against the end posts, to keep it in shape while assembling the rails and intermediate posts. Cement the pair of timber supports under the arch, and bridge is complete. Give the entire job two coats of brushing lacquer in a Chinese red, with the exception of the footboards, which are to have a weathered tone. Oil stain should be used for these.



Completed Bridge, View of Lagoon with Bridge in Place, Details of Torii, and View of Finished Garden

Now you can go ahead with the lake bed. A pint can full of portland or waterproof cement will be enough for the job. You can get this small quantity from some contractor who has a construction job in the neighborhood. In a bucket or large pan, mix about three parts sifted, dry sand with one part of the cement. Mix them dry, and then add enough water to make it about the consistency of the mud pies of your childhood. With a small trowel, spread it around in the lake depression to a depth of ½ or ¾ in., and bank it up around the sides. Have a quantity of clean, small stones of odd shapes and sizes on hand to set in the cement at the edges, and press the cement up into all crevices with the fingers. See that the lake level will be high enough and then push the bridge supports down into the concrete. Cement, by the way, should be kept fairly moist while hardening. Don't set it out in the hot sun. Half an hour after it has been laid, spread cloths over it and sprinkle a little water over them from time to time, just enough to keep them damp.

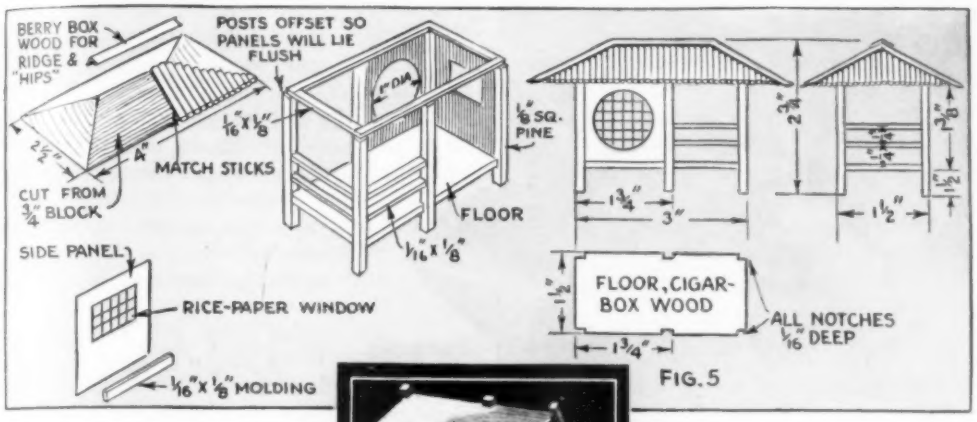
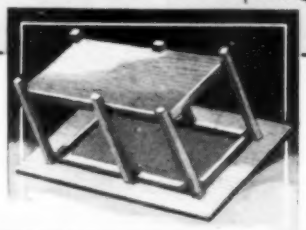


FIG. 5



Complete the soil arrangement, something after the layout shown in the plan, Fig. 3. Keep the soil moist and well packed down. Here and there between the rocks, imbed tiny rock plants. There is a seemingly endless variety of these, and if your local nurseryman cannot supply them, he will advise where to send for some. Many of them have very small leaves and are particularly suitable for this type of garden.

Build up the rock work and soil to a little eminence, about 5 or 6 in. high, where the summer house is to be set. A dwarf pine, with its twisted branches, is almost indispensable to this type of garden, and if you are unable to procure the genuine Japanese variety, or what is commonly known as a prostrate juniper, a cypress seedling can be trained into an odd shape by twisting a stiff wire around it and bending it to the desired position. In a few weeks, it will retain the shape and the wire can be removed. Dwarf ferns are very attractive along the edge of the lake, and one especially suitable is the polystichum angulare. As the garden should be kept inside, or at least in the shade, common forest moss is satisfactory for "sod," and on the Pacific coast helixine and arenaria are available for this purpose. If you have no other choice, any small-leaved shrub seedlings such as Cotoneaster thymafolia can be used for trees, and kept down to proper proportions by occasional pruning. A very tiny water plant, called duckweed, and another slightly larger, known as salvinia, are very attractive in the lake. The water should be changed several times at first to remove all cement and other solubles.

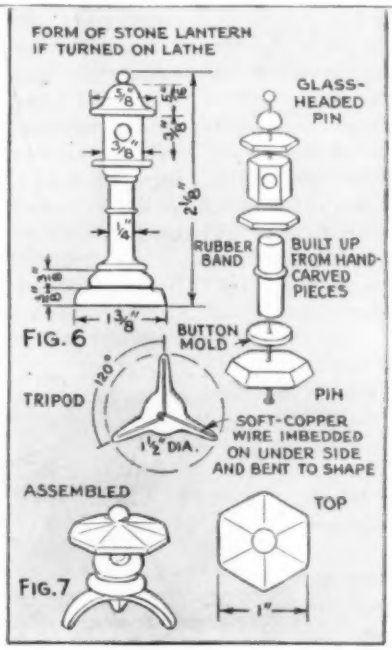


FIG. 6

FIG. 7

Construction of the torii, or so-called sacred

arch, Fig. 4, is extremely simple, consisting of two hand-carved uprights (to imitate hand-hewn logs) with a mortised cross timber, and two curved pieces above it. A small plaque or shield is cemented at the center of the cross timbers. Paint the entire job Chinese red, with the curved top piece black, and gold or bronze on the shield. If you know how to apply such delicate material, gold leaf is very effective on the shield, shellacked over and having some Japanese character painted in black waterproof ink. Press the arch in the soil at about the location indicated in the plan drawing.

View of the Garden Taken from the Rear of the Summer House; Note the "Stone" Lantern at the Left

The little summer house, shown in Fig. 5, is a very important feature, and is quite easily built of ⅛-in. square white-pine posts, 1/16 by ⅛-in. plates and porch rails, and a roof whittled or planed from a piece of ¾-in. white pine. Siding is made of berry-box wood, cut with a safety-razor blade and cemented in place. Japanese rice paper is used for the windows, or "shojii." Mark out the little squares in black waterproof ink with a ruling pen, and cement the paper on the insides of the window openings before installing the panels. The paper should be treated with model-airplane dope to render them tight as well as waterproof.

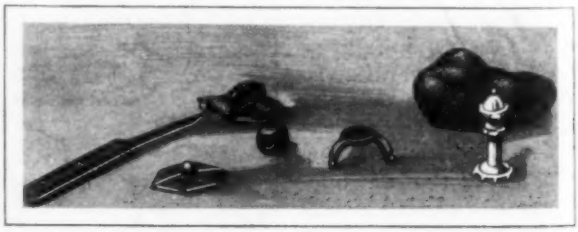
A thatched roof is very difficult to make, and a much more effective job is achieved with match sticks or small applicator sticks, cemented in place, with strips of berry boxes placed over the ridge and hips. Give the entire house an application of oil stain in a light-brown or weathered tone. You will note that the floor is made from a clean cigar-box lid. For a true Japanese effect, the floor should be shellacked or waxed to a fine polish. And remove your shoes before you enter!

The tall lamp, Fig. 6, is built up of small pieces of white pine, and the more rotund design of clay. The former can be turned on a lathe and the hexagonal portions whittled with a jackknife. Pins and airplane cement are used on the wooden models.

The clay lamp, Fig. 7, requires a little more skill and care. For the tripod or base, roll or spread the clay on a dry board to about ⅛-in. thickness and with a moist knife cut the legs to shape. Then press small copper wires into each leg, on the underside, and bend them to the required shape. Allow them to set half an hour or so before putting on the weight of the other pieces. Push a pin up through the bottom to hold the lamp together. Don't let the clay dry too fast, and while it is still moderately soft, give it a coat of shellac and immediately dust it with a mixture of very fine dry sand and portland cement. The sand should be sifted through a tea strainer, as well as the cement. Treat the wood model the same way. Enough sand and cement adheres to give the lamps a very convincing old-stone effect.

As a miniature garden of this size is rather heavy to move around frequently, it should have a permanent stand of its own, preferably near a window where it will get a little sunlight at some time during the day. Keep the moss and plants well watered, but do not sprinkle directly on any of the little structures.

The original proved so attractive that I have accorded it a place of honor in our dining room, and have even added two tiny live minnows to the life of the pool.



The Lanterns, Showing the Clay Parts for the Smaller One Before Assembling, and the Taller Lantern at the Right

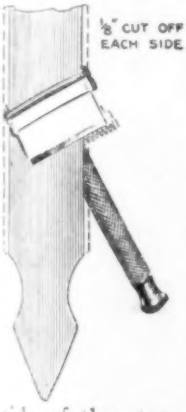
Cleaning Generator Commutator

Frequently auto generators stop charging owing to oil and dirt on the commutator. In such cases a rag, moistened with a cleaning fluid that is not inflammable, can be used to clean off the oil and dirt. It is highly important that a non-inflammable cleaning fluid be used for the purpose so that a spark from one of the brushes will not set it afire.—E. T. Gunderson, Jr., Humboldt, Iowa.

Removing Water Marks from Polished Table Tops

It is not necessary to refinish a whole table top just because it is marred with a water mark. Place a small quantity of olive oil in a pan and shave off a little white wax into the oil. Apply a small amount to the spot and rub well. Use any old linen rag but rub in one direction only, as rubbing in a circle will injure the polished surface.

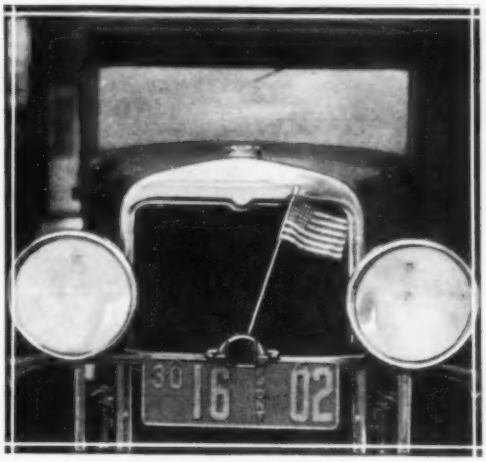
How to Strop Razor at an Angle



While the blades of the self-stropping type of safety razor may be used over and over, it is seldom possible to give them the keen edge of a straight-edge razor blade, owing to the fact that it is usually impossible to strop the blade at an angle. This trouble can, however, be overcome by taking a pair of shears and cutting a narrow strip off each side of the strop, which allows the razor to be held at an angle when stropping, as shown in the drawing.—Floyd A. Meek, Rockbridge, Ill.

Curtain Rods for Screen-Door Guard

Children are likely to push and kick against the screen door without thinking of the consequences. To prevent a broken screen, get three or four small curtain rods from the 5 and 10-cent store, and attach them across the door at the proper height.



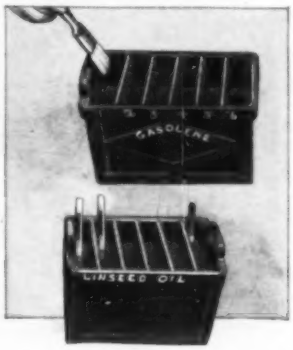
Old Windshield Wiper of the Suction Type Makes Automatic Flag Waver

Automatic Flag Waver for the Auto

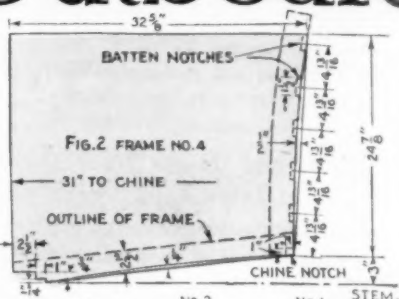
An old windshield wiper of the suction-operated type makes an excellent flag waver for holidays. It can be mounted in almost any position where the flag will be conspicuous, although the cross brace between the lamps has been found especially suitable. It is not advisable to mount it on the radiator cap, as it is likely to work loose. Substitute a rattan stick, about 18 in. long, for the wire holding the wiper.

Battery Box for Storing Paintbrushes

For cleaning and storing paintbrushes, a rubber battery box, having compartments as shown in the drawing, will be found highly convenient. Fill one of the compartments with gasoline for cleaning purposes. The ridges on the bottom assist in cleaning the brush if the bristles are rubbed back and forth over them. After a brush has been cleaned thoroughly, rinse it in the second section, also containing gasoline, and then place it in another containing linseed oil.



"ROAMER"—A Outboard



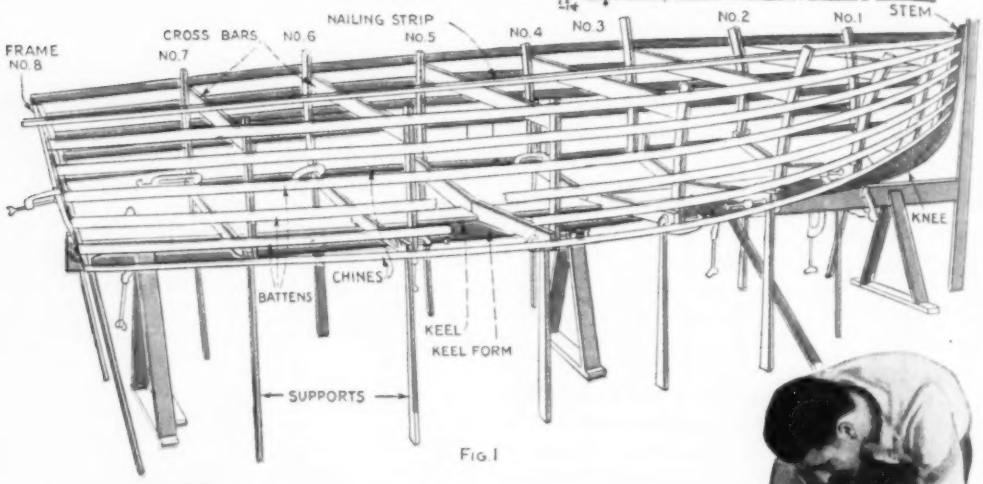
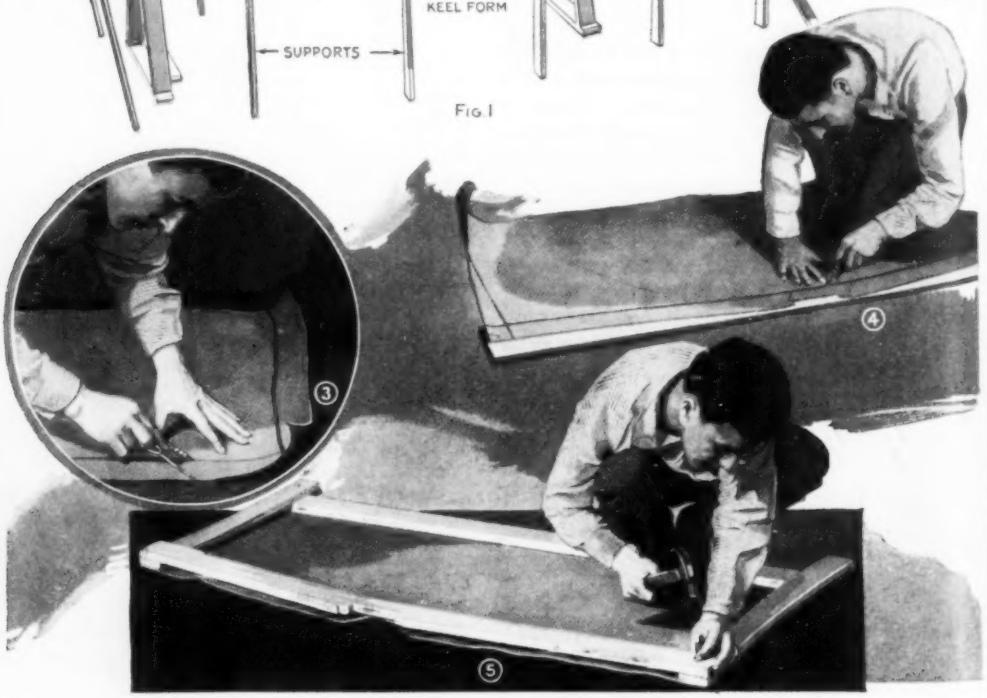


FIG. 1

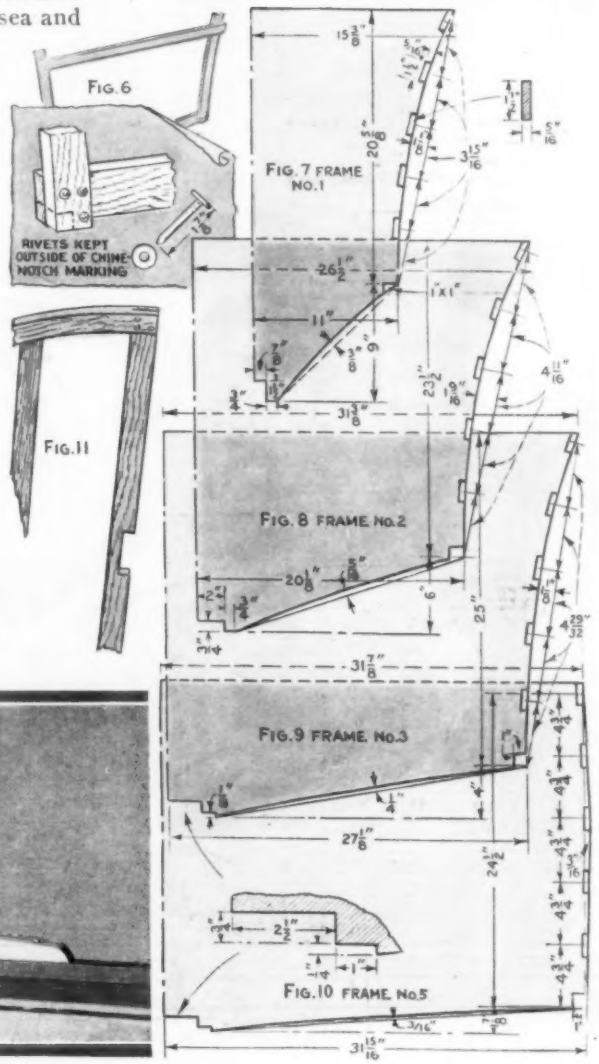


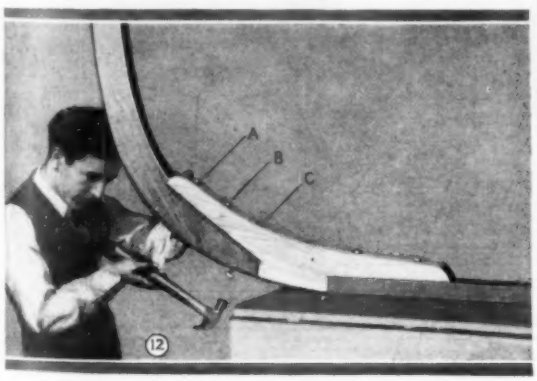
A Speedy Cruiser—*Part 1*

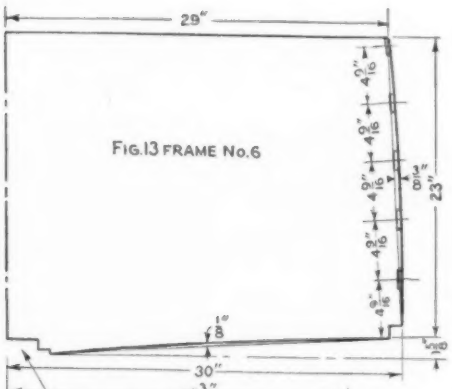
by Sam Brown

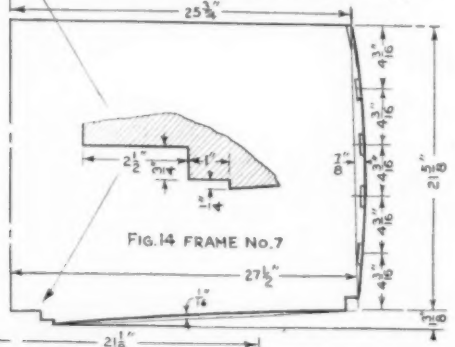
WITH any of the larger motors, this 733-lb. hull, 6 ft. wide and a full 16 ft. long, will average 26 miles per hour, while giving you maximum safety and comfort. Dry, safe, fast and comfortable—what more, with the tang of the sea and a blue sky, could any man desire? "Roamer" is worth building well. Starting now, you can easily finish this smart little craft in plenty of time for next year's boating season, and this without hurried, slipshod workmanship.

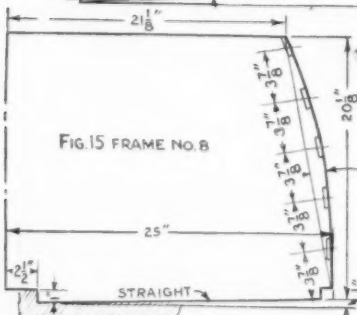
Figure 1 shows what you are to do this month. The first task in duplicating this assembly consists in making the eight frames which form the boat. The patterns for these should be drawn on heavy building paper. Start with frame No. 4. This is shown in half section in Fig. 2, so, in order to get the full shape, it is necessary to make the drawing on a doubled piece of paper. Cut it out along the outside line in the sketch, then open the folded paper on the floor. Set the points of a pair of compasses











2½ in. apart, and, keeping the steel point over the edge of the paper pattern, run in a line with the marking end, as shown in Fig. 3. The section of paper between this line and the outer edge of the paper is an actual outline of frame No. 4.

All frames are to be cut from ¾-in. material. White oak is an excellent wood to use, but red elm is really the best frame lumber for a boat of this size, as it is considerably lighter than oak. Almost any durable wood will serve. Slip a 6-in. width of the wood selected under the paper pattern, and pencil off the long V-section. A pencil can be used only around the outside of the paper. In making the inside line, use a toothed wheel, as shown in Fig. 4. By running this firmly over the line, the sharp teeth will pierce the paper and leave a perfect impression.

The next job is to cut the V-section out, and then to outline and cut the two shorter pieces which form the sides of the frame. In cutting these, allow about 2 in. more wood at the top than the paper pattern shows. Mark the positions of the chine and batten notches, as indicated in Fig. 2.

The three pieces, when cut, are placed just where they belong over the paper pattern, and lightly fastened together with nails, as in Fig. 5. In ad-

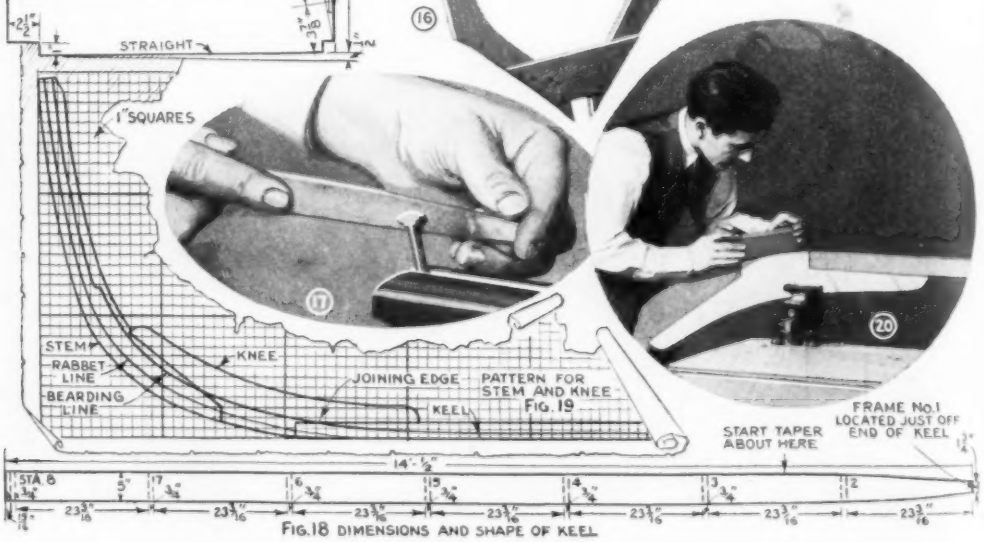


FIG. 18 DIMENSIONS AND SHAPE OF KEEL

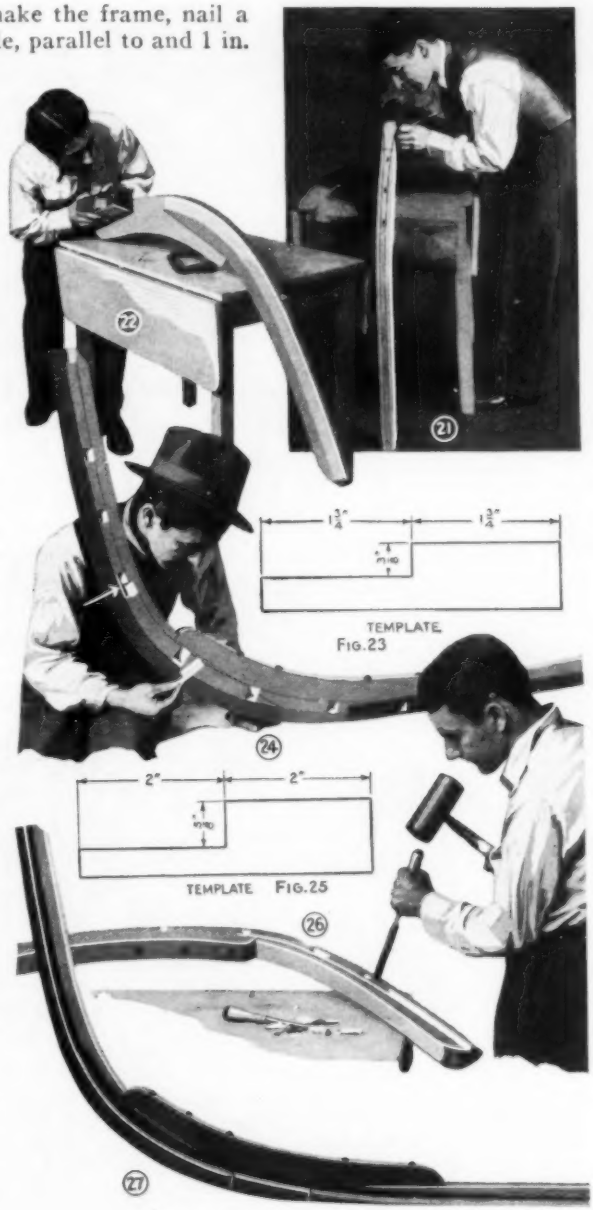
dition to the three pieces which make the frame, nail a temporary crossbar from side to side, parallel to and 1 in. below the top of the paper pattern. Mark this piece with a centerline. When the frame is trued up to your satisfaction, the two short pieces are fastened to the V-section with copper rivets, three to each joint, as in Fig. 6. Notice that the rivets are placed outside the chine-notch markings. Coat the joining edges of the wood with heavy paint before fastening. This rule applies throughout the construction—no bare wood in the joints.

Frames 1 to 8, Figs 7 to 15, are drawn on paper, cut, and fastened in a similar manner. Frame 8 varies from the others in that the joints are half-lapped, as in Fig. 11. Frame 1 is different in that it is made from two sidepieces only, fastened together with a short crossbrace, as in Fig. 16.

Now for the keel. Fig. 18 gives the dimensions. The rear end of this piece is straight, so, by using a plank of the proper width, it is only necessary to taper the forward end. Use white oak, 1¾ in. thick. Do not forget to mark the places where the frames will be stationed, indicated in the diagram.

Both stem and knee are cut from pieces of 1¾-in. white oak. The shapes of these two pieces and the manner in which they fit together are shown in Fig. 19. No dimensions are given, but each square in the diagram represents 1 in. This means another drawing on the building paper, making each square the full 1 in. and then drawing the shapes of the stem and knee accordingly. Also, mark the position of the rabbet line and the bearding line. Transfer the drawing to the wood, and cut out the two pieces.

Next, bolt stem, knee and keel



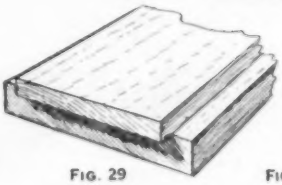


FIG. 29

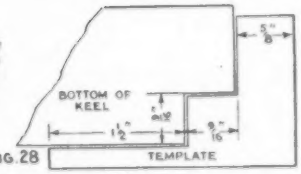


FIG. 28

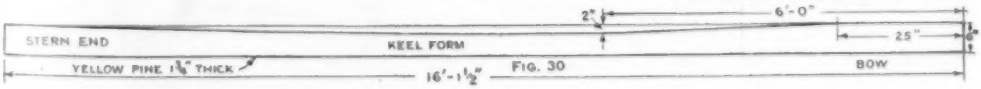
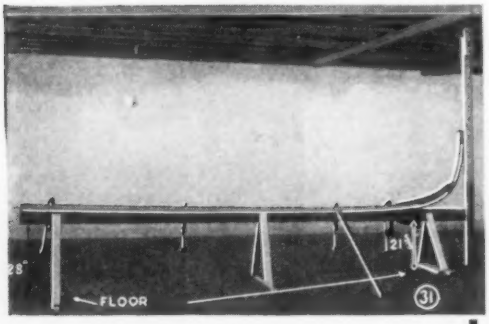
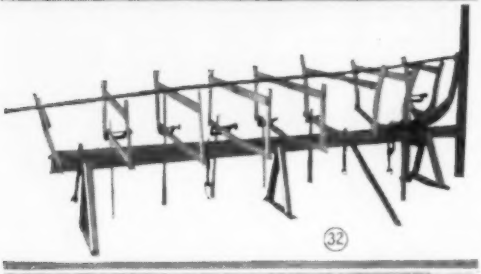
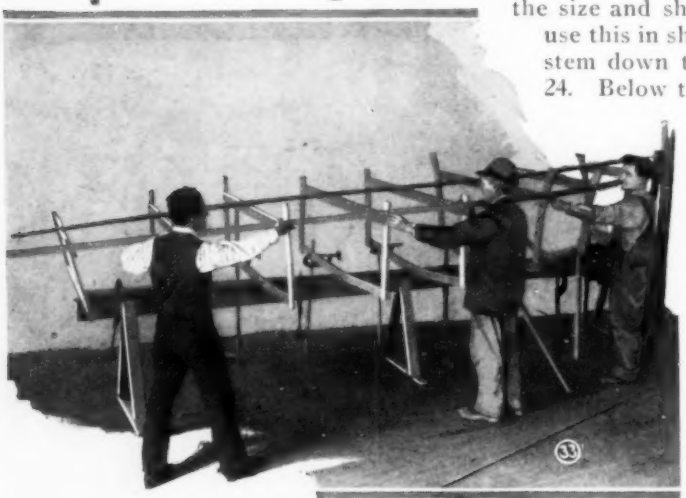
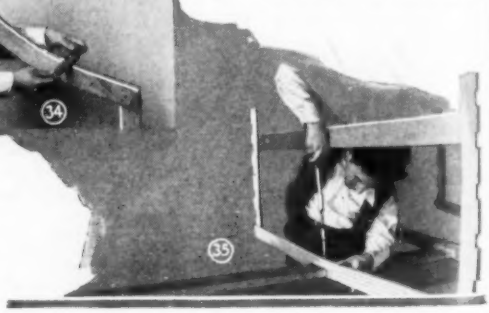


FIG. 30







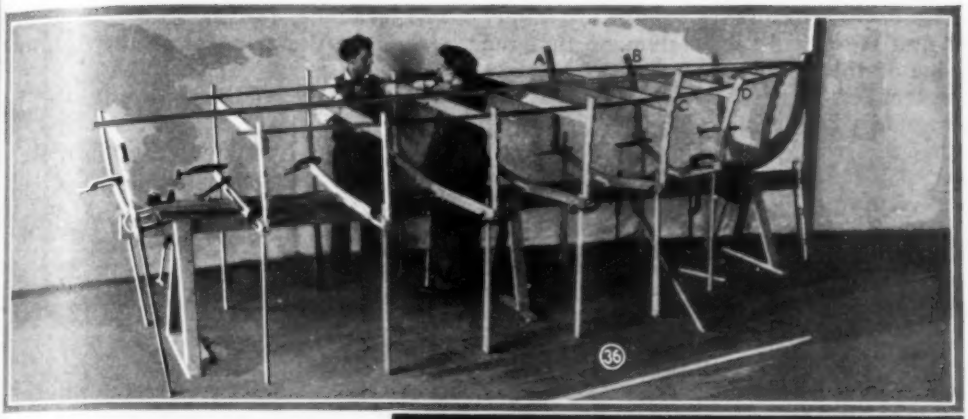


The rabbet comes next. This is a long, running notch in the stem and keel, so cut as to permit the planking to fit into place. You already have a rabbet line and a bearding line marked on one side of the sawed-out stem, these marks taken from Fig. 19. These lines should be duplicated on the other side. Draw a centerline down the front of the stem, and continue this mark along the full length of the keel on the underside. Two other lines, parallel to this centerline and at a distance of 3/16 in. on either side of it, must be drawn as shown in Fig. 21. Notice that these lines gradually widen at the bottom to merge into the keel.

Use a plane to bevel away both forward corners of the stem from the rabbet line on either side to the off-center line on the same side, as shown in Fig. 22. Cut a template from thin wood or cardboard of the size and shape shown in Fig. 23, and use this in shaping the rabbet along the stem down to the arrow mark in Fig. 24. Below the arrow mark, the rabbet is cut 5/8 in. deep instead of 3/8 in., in order to take in the heavier, double planking which is to go on the bottom of the boat, and another template, of the size shown in Fig. 25, should be cut for this. The manner of using these templates is shown in Fig. 24, small sections being cut out to the templates every 6 in. or so, and the intervening wood then cut away as in Fig. 26.

Cutting the rabbet along the stem and knee is no picnic. Unless you

together. Five 1/4-in. galvanized or brass carriage bolts are used for this purpose, and their placing can be readily determined from Fig. 12. The heads of bolts, A, B and C are filed flat, as in Fig. 17, so that they will not interfere with the later shaping of the stem. All bolts must be countersunk neatly. After bolting, you will find that the keel projects a trifle beyond the knee. Round off this projection to a gradual sweep, as in Fig. 20.

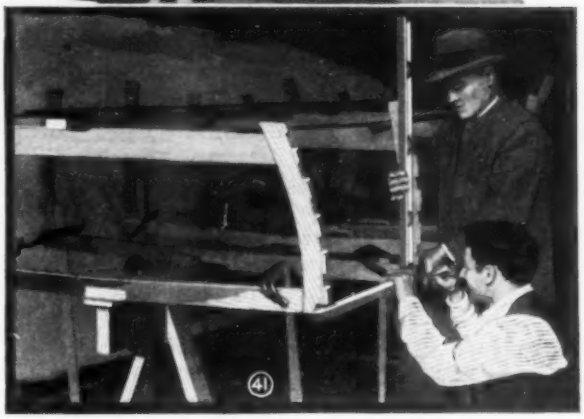


are skilled at this business, it is best to leave a little extra wood to work on instead of at once cutting the rabbet to the full depth. Fig. 27 shows the stem, knee, and forward part of the keel fully rabbeted. The rabbet along the rear of the keel is almost a square cut —use the template shown in Fig. 28, and then trim the line to shape after the frames are set in place. The cutting-away process also continues around the rear, the wood being cut as pictured in Fig. 29.

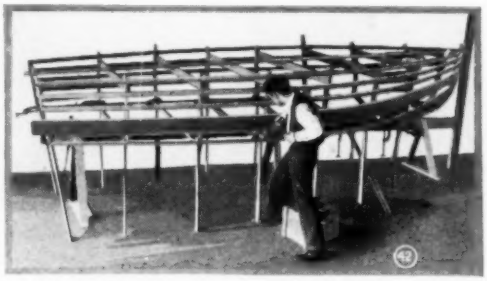
Commence assembling by cutting a plank of the shape shown in Fig. 30. This plank is the "bench" upon which the boat is built. It is supported at the distances from the floor shown in Fig. 31. This picture also shows how the keel and stem assembly is placed upon this curved plank and held in position with clamps. The upright timber against the stem should be plumbed true, and anchored to a rafter. The top of the stem should be toe-nailed to this timber. The sawhorses should be nailed down.

The best way to fit the frames calls for a preliminary assembly and truing-up of the frames, then a removal of the frames for beveling and notch-cutting, and the final assembling.

The frames are set in position and lightly toe-nailed to the keel. Now, look at Fig. 32. The long



strip of wood across the tops of the frames is first toe-nailed to the stem, so that the edge of the wood lines up with the stem centerline. The centerline on each frame crosspiece is then lined up with the edge of the strip and nailed. Before nailing, make certain that the distance between frames at the top is the same as at the bottom—23 3/16 in. Test by using a plumb bob on each frame. No. 8 frame is not plumb, but is set 2½ in. out of plumb, as can be seen in the picture.



Each frame is then leveled horizontally, and light pieces of wood from the corners of the frames to the floor, as in Fig. 32, are used to maintain this balance. These two leveling processes do not completely true up the frames, but they are sufficient to enable you to do fairly accurate frame beveling. For this, take a long strip of thin wood and spring it across the frames from end to end, as in Fig. 33. The curve of this stick is the curve which the planking will take. Notice, however, that the stick does not run flat across the frames; it rides only on the forward edge of the forward frames, and the rear edge of the after frames. The remedy consists in marking the proper amount of bevel on each frame at various levels; then removing the frames, one by one, for the beveling. Fig. 34 shows the bevel being cut on frame 3. Once the sides and bottoms of all frames are correctly beveled, the chine and batten notches can be cut out. The bottoms of these notches must be cut on the same angle as the frame in which each one is cut.

Now the final assembling can be done. Two No. 10 galvanized or brass screws of suitable length are used to attach each frame to the keel, as shown in Fig. 35. Both the leveling-up processes described before are checked over carefully and the frames readjusted if necessary. A third truing-up step calls for two light pieces of wood nailed to the crosspieces immediately inside each frame, as shown in Fig. 36. These are not fastened until the distances between frames are equalized. For example, the distance AB, Fig. 36, should be the same as the distance CD, etc.

That completes the set-up. Since much depends on this part of the building, check the whole thing over again to make certain that you are absolutely correct. This applies especially to the horizontal balance, controlled by the wood pieces which extend from the frame corners to the floor. Use a level or plumb in testing these again, as in Fig. 37, tapping down one stick or the other until perfect horizontal balance results. You will notice that quite a number of clamps have been used on these sticks. They can be nailed equally well, and then adjusted by thin pieces of wood slipped under them.

The 1 by 1-in. white-oak chine pieces are fastened into place with 2-in. No. 10 flat-headed brass screws, one to each frame, as shown in Fig. 38. Drill holes for these screws, and countersink so that the screw heads will be flush or slightly below the wood surface. The front end of the chine is notched to fit onto the stem immediately behind the rabbet, Fig. 39, and fastened with a galvanized nail from the top and a brass screw from the side, as in Fig. 40. It is advisable to fit this joint first, and then work along the frames. No exact mark where the chine should meet the stem can be given—merely line it up, with clamps, in the frame notches and let the natural sweep determine its position. Before fastening each frame to the chine, be certain about the "uprightness" of each frame, testing with a level or plumb bob in the manner shown in Fig. 41.

The battens; which are long slips of ¾ by 1½ in. spruce, are merely slipped into their proper notches and fastened at each frame with a single 1¼-in. No. 6 brass screw. Each batten is centerlined before being fastened into place, and the screw inserted on this line. The forward ends are beveled to lie snug against the stem immediately behind the rabbet.

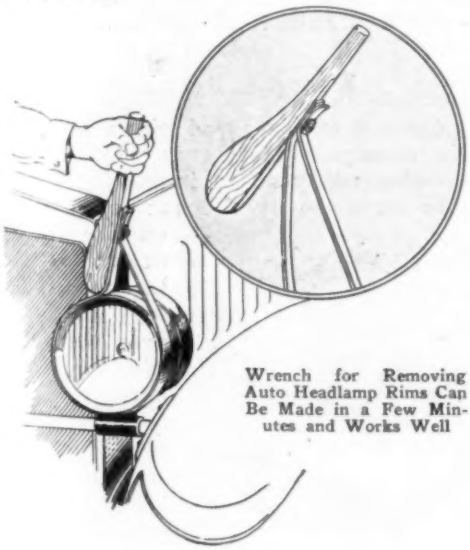
Figure 42 shows what you will be doing next month—putting on the planking. This is ⅜-in. thick mahogany, white cedar or white pine. You will need 22 pieces, 6 in. wide and 17 or 18 feet long, so have it on the job, all set for next month's installment.

Packing Box and Electric Lamp Make Drying Cabinet for Baby's Clothes

For drying the baby's clothes when the weather does not permit hanging them outside, get a clean packing box of suitable size and fit an electric light in the inside. A wire shelf is hung directly over the light, the heat of which soon dries out the clothes laid on the shelf.—Miss Durfe Rockwell, Hollywood, Calif.

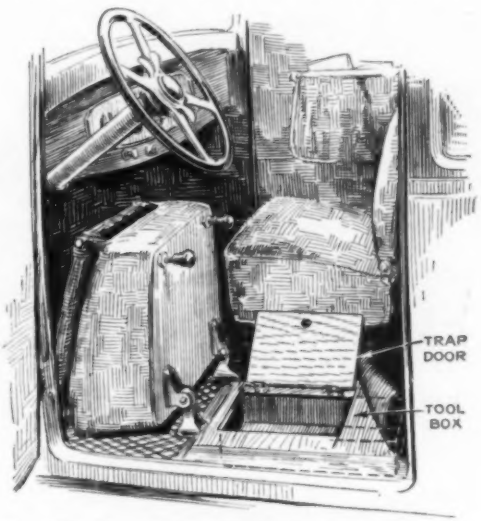
Wrench for Removing Rims of Auto Headlamps

When you find it difficult to remove your auto headlamp rims, try the home-made wrench shown in the drawing. It consists of a length of leather belting with both ends bolted to a hardwood handle of the shape shown. The loop of the belting must be large enough to be slipped over the rim, and the handle is brought back to the position indicated so that considerable leverage can be exerted. You will find that this wrench saves much time and trouble.—Chas. H. Willey, West Concord, N. H.



Wrench for Removing Auto Headlamp Rims Can Be Made in a Few Minutes and Works Well

Auto Toolbox under Driver's Seat



Handy Toolbox under Driver's Seat Eliminates Inconvenience to Other Occupants

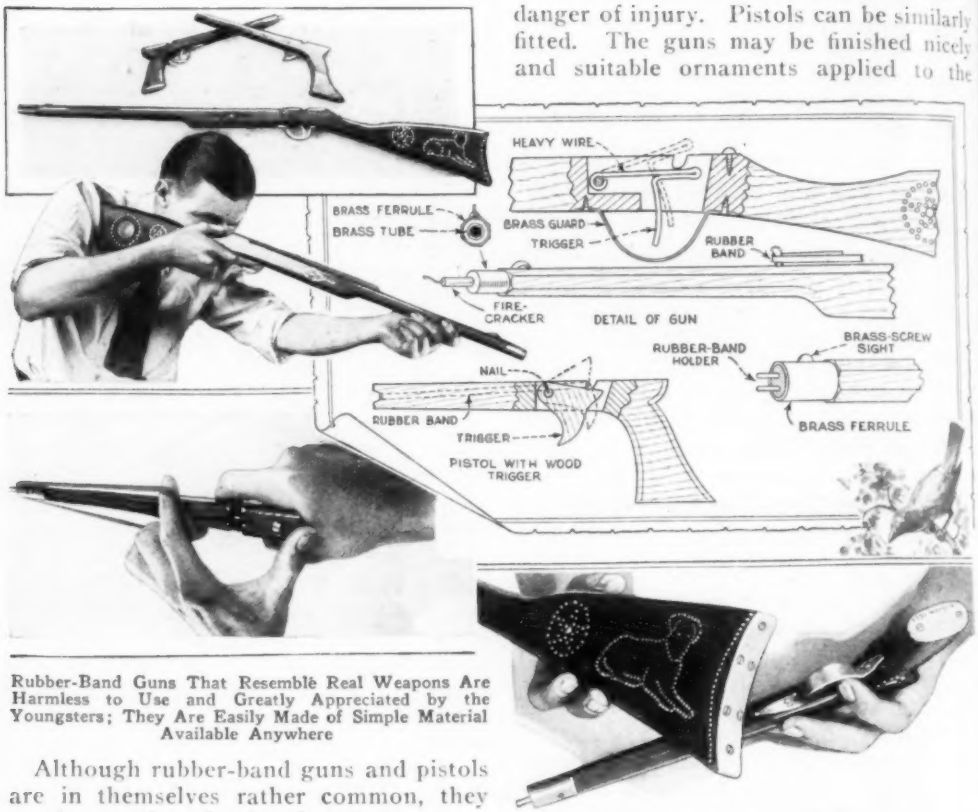
Getting at the toolbox under the rear seat of a car is usually rather inconvenient in the case of two-door sedans, especially if the occupants must get out. As the driver is the one who must get out when repairs and adjustments are made, he can avoid unnecessary bother by having a toolbox arranged under the floorboards, directly under his seat, which swings forward as shown. A square hole is cut in the floor and a hinged trapdoor, fitting flush, is provided. A strong, wooden box, a trifle larger than the hole, is attached to the underside of the floorboard by means of small angle brackets. Of course, the available space underneath the floorboards should be measured and a box of suitable size obtained, before the hole is cut.

Checking the Work of Ants

To keep ants off the dining table, it is not necessary to place the table legs in cups of water. The following method will be found to be much better: Dip some string in kerosene and wind it around the feet, tying it securely. This will prevent the ants from passing.—L. H. Georger, Buffalo, N. Y.

¶Gasoline feed pipes should not be allowed to vibrate; tie them with rawhide thongs.

RUBBER-BAND GUNS FOR THE BOY'S ARSENAL

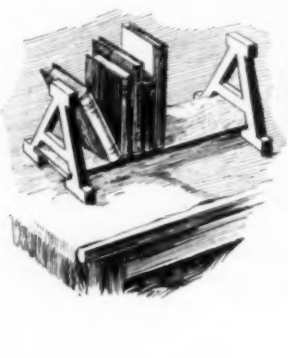


Rubber-Band Guns That Resemble Real Weapons Are Harmless to Use and Greatly Appreciated by the Youngsters; They Are Easily Made of Simple Material Available Anywhere

Although rubber-band guns and pistols are in themselves rather common, they can be greatly refined and made to resemble real guns, as indicated in the drawing. One end of the rubber bands, which are ¼-in. strips of inner tube cut crosswise, is slipped between two pins at the muzzle of the pistol, while the other end is brought back and slipped into a notch cut across the gun directly over the trigger. To release the band from the notch it is only necessary to pull the trigger, which is pivoted in a slot. Either heavy wire or thin wood can be used for the trigger. In the case of a rifle, a single pin, driven into the top side of the barrel, halfway between the muzzle and trigger, serves to hold the rubber band. If desired, provision can be made for shooting off firecrackers from the end of the gun. A brass ferrule is first driven on the end of the barrel and a tube of the same material is then driven into the end, a hole being drilled for the purpose. Firecrackers can be inserted in the tube, and, as the barrel is held away from the user, there is practically no danger of injury. Pistols can be similarly fitted. The guns may be finished nicely and suitable ornaments applied to the stock. In the examples shown, small brass brads were used to decorate the weapons with a starlike figure and a hunting dog. —Addison Bain, Marion, Ohio.

Monogram Book Ends

Cut out of 1-in. wood with a bandsaw, the monogram book ends shown in the drawing represent an interesting departure from the usual block type. Both ends are made at the same time, slots being cut to fit over the edge of a horizontal board on which the books are set. The snugness of these slots determines the ri-



gidity of the assembly as the ends are not permanently fastened but are designed to slide along the board to accommodate any number of books. Hardwood is best suited to the purpose.—Herbert Pike, Ames, Iowa.

Preventing Blotches with French Curve

Often beginners experience difficulty with the use of a French curve in that the ink adheres to its edge when the line is made too close, and when the curve is pulled away, a blotch results. To avoid this trouble, get two ordinary paper clips and slip them over the edge of the curve on each side of the portion where the line is to be drawn. The clips will hold the curve away from the paper so that there will be no possibility of the ink getting on it.—Ralph A. Muth, Catasauqua, Pa.

Quick Boiling for Campers

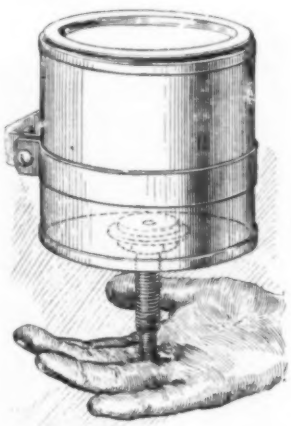
Although rather odd in shape, the boiler shown in the drawing has been found highly efficient, and especially useful to campers. A hole is cut in the bottom of an ordinary copper or iron boiler and an inverted can is soldered to the edges of the hole as indicated. The can must be large enough to give room inside it for a small heater, burning solidified alcohol. A number of rivets are soldered to the bottom to extend underneath, so that air will reach the flame when the boiler is placed on a flat surface, such as the top of a stove. It has been found that ½ gal. of water can be brought to the boiling point in a short time with this boiler. All the heat from the flame is caught in the can, which conducts it directly to the liquid. In this way a relatively large heating surface is obtained over a small flame.—James E. Noble, Toronto, Can.

Delivery Box for the Screened Porch

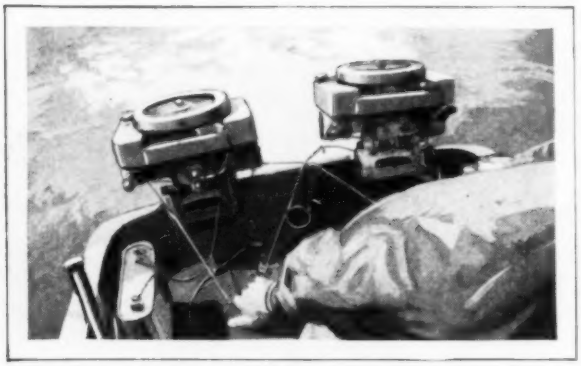
Delivery Box, Having Doors on Either Side, Prevents Excessive Use of Door

As delivery men do not like to leave parcels on the steps, we seldom closed the door of the screened porch. This made it easy for the dog to get in and out, and the result was that we had many more flies than would be the case if the door could have been kept closed. The trouble was, however, readily overcome by providing a special delivery box as shown in the drawing, to which access is possible from either side.—H. Mercereau Geer, Binghamton, N. Y.

Tin Can and Air Valve Used for Liquid-Soap Dispenser



It takes only a few minutes to make the liquid-soap dispenser shown in the drawing. Get a tin can and solder a tire valve in the bottom. Then make a bracket to hold the dispenser on the wall. Pressing the core of the valve upward causes the soap to flow out.—Hayes J. Wilson, North Platte, Nebr.



Hooking Up Two Outboard Engines So That They May Be Turned, for Steering, at the Same Time and to the Same Degree

Steering Two Outboards on Speedboat

A simple rig for steering a speedboat which is run by two outboard engines, is shown in the photo. Two pieces of rope are used; one piece is tied to the left-hand motor steering arms on both motors, and the other to the right-hand arms. A pull on one rope will then swing both motors in the same direction. In the photo the pilot's right hand is seen pulling the right-hand steering arms forward. The loops of the ropes are held so that as the right hand is pulled forward the left is allowed to go back, and vice versa.

Banana Crate Protects Young Shrub

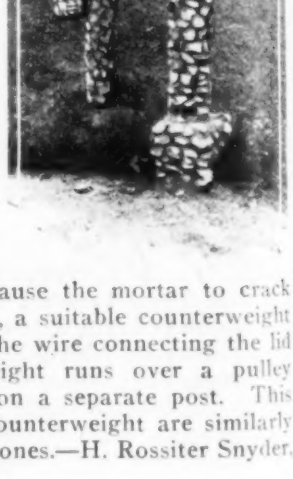
The efficiency of burlap, heavy paper and other material commonly used to cover young shrubs during the winter months, can be greatly increased by the use of banana crates as shown in the photo. In accordance with the usual practice, the shrubs are wrapped more or less tightly, but with such a crate, a softer wrapping is made possible so that there is less chance of injuring the shrub.—F. Bentley, Jr., Missouri Valley, Iowa.

Built-In Telephone Cabinet

Where to place the telephone is a problem frequently encountered. When building a home, this problem can be solved by providing a built-in cabinet between the dining room and the kitchen. A box of proper size is set in the wall before the plastering is done, and a door on each side is provided, using butt hinges that will not show. The door on the dining-room side should be flush with the wall so that a picture can be mounted on it to hide it. On the kitchen side, the box may extend a little, and the wood be painted to match the rest of the woodwork. The telephone is accessible from both rooms.—Edgar C. Hanford, Springfield, Ohio.

Attractive Rural Mail Box Covered with Stones

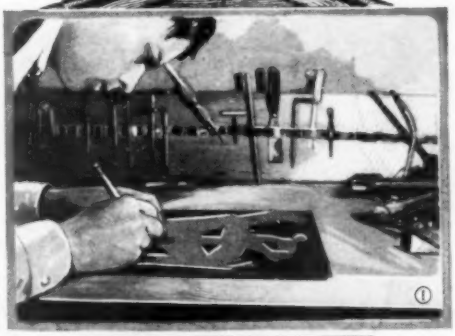
Differing from the common type of mail box, the one shown in the photo is quite attractive. A wooden box with a hinged top is set on a post, and the surfaces of both post and box are covered with metal lath to hold mortar, into which stones are imbedded. The lid is also covered with mortar and stones and is therefore quite heavy. As one might drop the lid, which would cause the mortar to crack in a short time, a suitable counterweight is provided. The wire connecting the lid and counterweight runs over a pulley which is held on a separate post. This post and the counterweight are similarly studded with stones.—H. Rossiter Snyder, Guilford, Conn.



NOVELTY WEATHER VANES

By DALE R. VAN HORN

WEATHER vanes are back in style again. Not the regular arrow type, but novelty vanes; weather vanes that tell a story or depict an interesting idea, silhouette fashion. With a little thought, you can work out a vane story that will stand for your hobby, business or favorite sport. All you need to make these vanes is a few cents' worth of sheet iron, some pipe and strap iron, a few rivets and a rod, then a little paint to finish them. A simple and effective vane is the one shown in Fig. 2. This represents a farmer planting seeds. He is in old clothes, big shoes and the familiar broad-brimmed hat. He must be placed at one end of the vane. Too offset this relatively large area, one of much smaller size is needed for the upwind end. A hen garnering the seeds just planted is suitable for this purpose.



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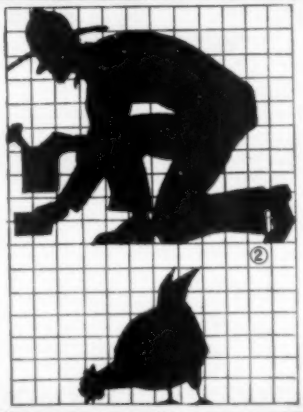

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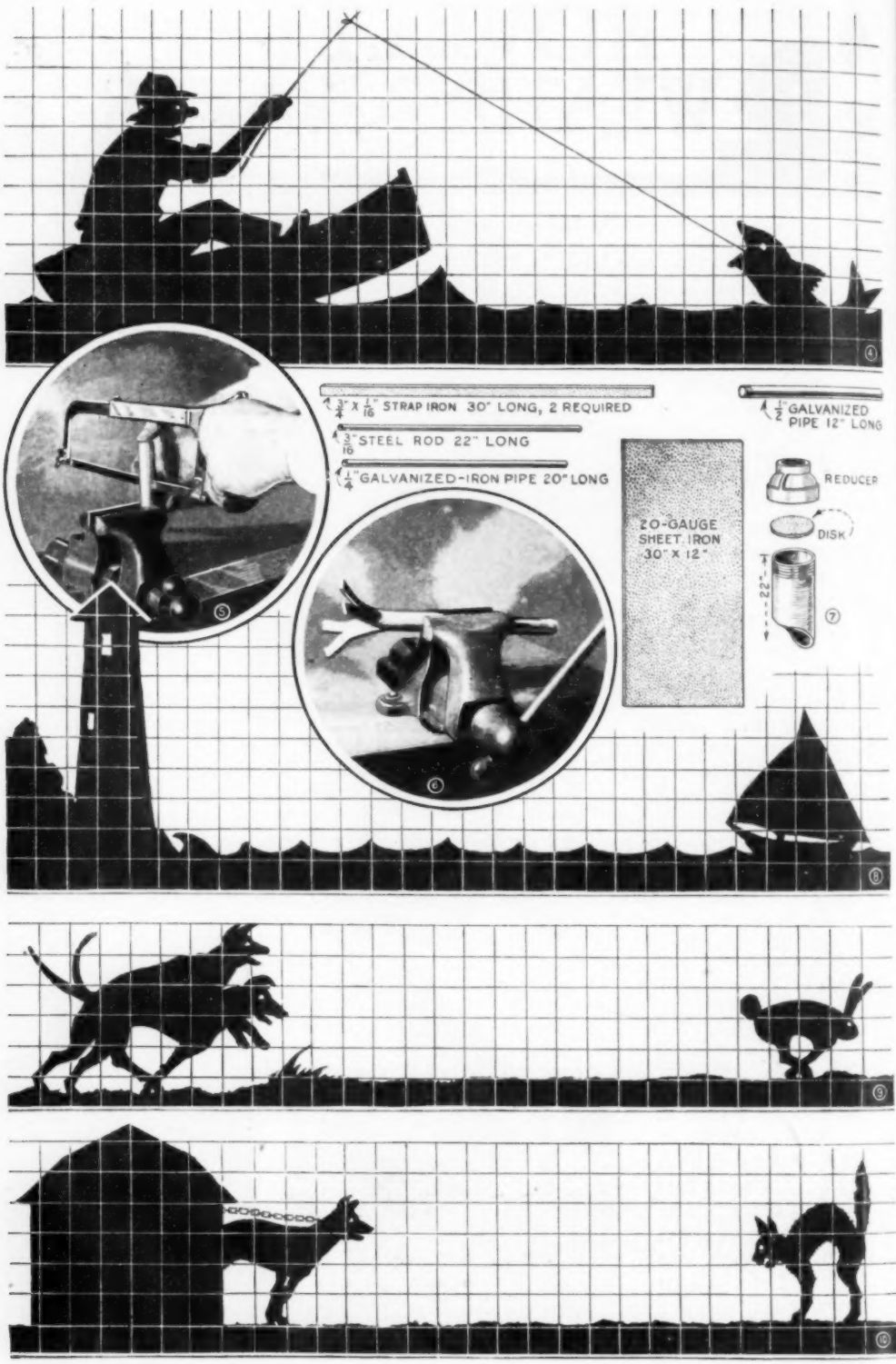
First, the pattern for both the hen and the planter is laid out on paper in pencil and spaced to give an over-all length of 30 in. Then the two figures are cut out and laid on a piece of sheet iron of reasonable thickness, 1 in. above the lower edge, and are traced on the metal with a pencil, as shown in Fig. 1. For the average weather vane, sheet iron a trifle too thick to cut easily with a pair of tin snips should be used, especially when the objects are large.

③

The best method of cutting the metal is by means of a cold chisel. A piece of railroad track or some other heavy flat bar iron should be used for an anvil, as shown in Fig. 3. Note that a continuous strip of the sheet metal connects the two, and the top edge can be cut in any irregular fashion to resemble plowed ground. Grass can be shown by cutting thin triangular pieces from the top edge. Waves can best be shown by a series of rather even scallops. To strengthen the silhouette, get two pieces of strap iron, say 1/16 in. thick and 3/4 in. wide. Rivet the sheet iron between them with the bottom edges of the three pieces in line. A break must occur, as shown, for the upright rod, which is of 3/16-in. steel. This is slightly flattened for 1 in. and is then clamped tightly between the strap irons a little upwind from the center, with a rivet on each side. Also be sure that the rod is at right angles to the bottom edge of the silhouette.

For the supporting


3/4" X 1/16" STRAP IRON 30" LONG, 2 REQUIRED
1/2" GALVANIZED PIPE 12" LONG
3/16" STEEL ROD 22" LONG
1/4" GALVANIZED-IRON PIPE 20" LONG
20-GAUGE SHEET IRON 30" X 12"
REDUCER
DISK
22"
4
5
6
7
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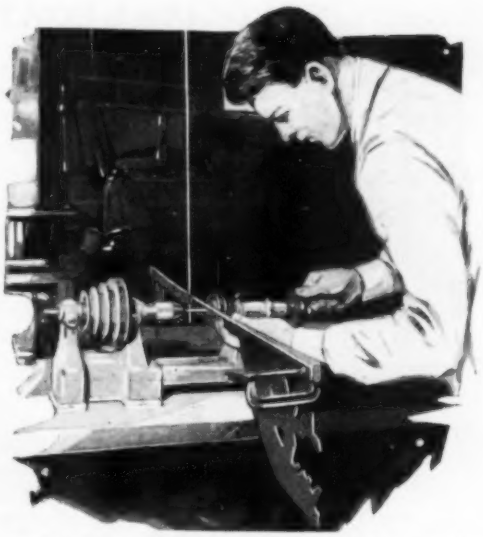
10

housing, get a piece of ¾-in. galvanized iron 12 in. long and threaded at one end. Provide a reducer for this to take a ¼-in. pipe, 20 in. long and also threaded at one end. Set the lower end of the larger pipe upright in a vise and make two cuts with a hacksaw at right angles to each other, one 1 in. deep and the other 3 in. deep. Then spread these to form two feet to fit the ridge. See Figs. 5 and 6. If you are to install the vane on a flat roof, make both hacksaw cuts 3 in. deep and spread the four feet evenly. Drill the feet for 3/16-in. lagscrews.

The parts for making the vane are shown in Fig. 7. Sharpen the bottom of the upright rod slightly, and place a metal disk on the top of the lower pipe to take the end of the rod, as shown in the detail, Fig. 7. Assemble the pipes, and drop the vertical rod in place. You can apply a little hard grease on the disk to insure easy turning for a long time. When completed, the horizontal piece should clear the top of the pipe by about ½ in. Before installing the vane on the house or garage roof, give all the metal parts a liberal coat of paint. While the color for the upright is optional, black should invariably be used for the silhouette. Four suggestions are shown in Figs. 4, 8, 9 and 10, but these are only a few of the possibilities.



Drilling Holes through the Silhouette and Strengthening Bars for Rivets

Pulling Car Out of Mud

When my auto seemed hopelessly sunk in a mud hole and the only salvation to get a near-by farmer to pull me out with a team, I remembered that I had an old pair of skid chains under the back seat, which I then proceeded to use to advantage. Two fence posts, found beside the road, were laid under the running board on each side and the chains fastened over the forward end, as indicated in the illustration, leaving the chain hooks extending toward the rear wheel. My regular chains were already on the rear wheels, and the hooks of the first chains were attached to them, where the posts touched the tires. Putting the car in low gear raised the wheel vertically, and then it came forward on the posts. In doing this, of course, the pressure on the back part of the posts threw the forward ends up against the underside of the running boards. This method has saved me quite a sum of money so far, as I have used it time and again.—Bernard McManus, East Moline, Ill.

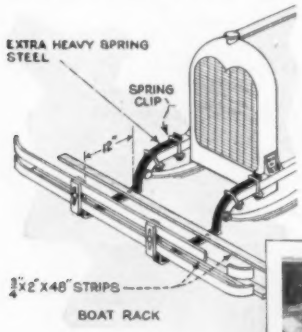
Effective Method of Getting Car Out of Mud

Comb for Cleaning Red Currants

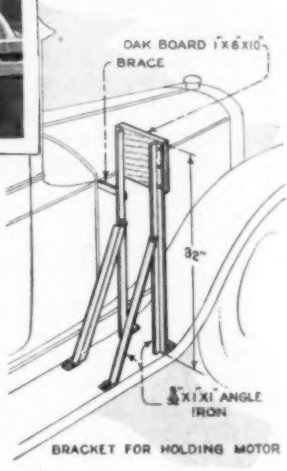
Preparing red currants for stewing or jam making is always a slow job as it takes some time and care to remove the berries from the stems by hand. This work can be done more quickly by using a coarse comb. Draw the stem through the comb and the currants will come off.—D. Leechman, Ottawa, Can.

CARRYING FOLDING BOAT AND MOTOR IN YOUR AUTO

For those who are going camping to a secluded spot at a lake where boats are not obtainable, a folding boat, which can easily be carried along, will be found satisfactory. Besides, a light-weight outboard motor can be carried along if desired, thus literally providing the camper with a portable motorboat. The photo shows a 14-ft. portable canvas boat folded and stored in its carrying bag on a special cradle made for it. The writer has carried such a boat nearly 30,000 miles in this way and it is still in good condition. Contrary to general belief, a bundle carried in front of the radiator, but separated from it by a sufficient space to permit circulation of air, will not cause the motor to overheat. Although it cuts off the air rushing through the radiator due to the forward movement of the car, the fan nevertheless draws enough air through to prevent overheating. The drawing shows the construction of the brackets, the exact dimensions of which depend on the particular make of car on which the installation is being made. It is best to take the car to a blacksmith's shop or auto-spring shop, where the main arms can be shaped to fit the car. Extra-heavy spring-steel stock should be used for the purpose and the arms should be fastened to the frame with spring clips instead of bolts, which would weaken the frame. The bottom of the bracket should be on a level with the bottom of the front axle. A convenient method of carrying an outboard motor is also shown. Two angle-iron brackets are bolted to the running board of the car and both are bolted to a short piece of 1-in. oak, on which the motor is clamped. The dimensions of this bracket depend on the particular kind of motor it is to hold.—Dick Cole, Los Angeles, Calif.



Camper's Portable Boat and Motor Can Easily Be Transported on the Car to Secluded Lakes



Homemade Varnish Remover

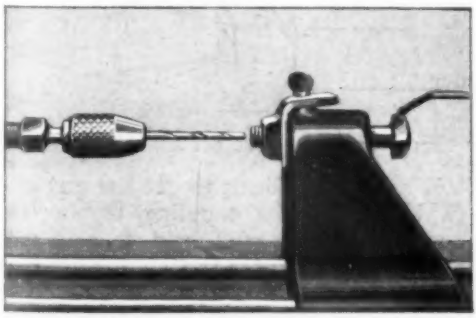
Here is an effective homemade varnish remover: Mix 1 cupful of flour in twice that amount of water. Dissolve ½ cupful of lye in an equal amount of water and add this to the flour mixture. Apply the paste with a cotton swab or cloth tied to a stick. Allow the paste to remain on the surface for just about one minute, after which the softened varnish can be removed with a spatula. If all the varnish does not come off, repeat the operation. However, you must be careful not to let the paste remain on the wood too long, as it will darken the latter, and for this reason it is best practice to apply the paste to small sections at a time. In case you do get some dark spots on the wood, the natural color can be restored by rubbing with a cloth dipped in vinegar. Another method of bleaching out the wood is to use a solution of oxalic acid, obtainable at any drug store.

Bleaching Dark Clothes

Before dyeing clothes, it is sometimes necessary to remove a darker color. This can be done easily with a solution of ordinary chloride of lime, which is a bleaching powder and can be obtained at any drug store. Make a solution consisting of about 1 oz. of the powder to 1 gal. of water. If there is plenty of time, simply soak the garment in this solution. The bleaching process can, however, be speeded up by heating the solution or by adding a few drops of sulphuric acid.—Ralph W. McPherson, Omaha, Nebr.

Feeding Iron Work to Drill in Lathe

Amateurs who are working small lathes without a screw-operated tailstock, often experience difficulty in feeding iron work to the drill when the set is used as a drill-press. To minimize this trouble, the following device has been found efficient. A piece of scrap iron of appropriate length is bent at right angles and the arms are drilled, one to accommodate the lock screw of the tail center, and the other to permit the easy passage of a bolt, as indicated. The nut of the bolt is centered and welded in position over the large hole. A 4-in. bolt is used for the feeding element, and the head is drilled to permit the insertion of a steel rod, which is bent to form a crank. Because of the variation in size of machines, it is useless to give specific dimensions. With care in forming the angle of the crank and in laying out the piece before drilling, however, no trouble should be experienced in adapting



Improvised Screw-Feed Attachment on Small Lathe for Feeding Work to Drill

it to any lathe.—Robert L. Swanson, Minneapolis, Minn.

Unused Ironing Board of the Built-In Type Converted into a Small Table

This Kitchen Table Folds into the Wall

As we preferred to have an ironing board in the laundry instead of the kitchen, where one was built in the wall, we converted it into a small table as shown. It was sawed off to a convenient length and an extra leaf hinged to it on one side. This leaf was made as wide as the ironing board and could therefore be folded back in the cabinet. A pivoted cleat under the ironing board was used to hold up the leaf when in use, and the cleat did not interfere when the assembly was folded. Most housewives will find such an extra table extremely handy.—Ralph Erskine, Washington, D. C.

Disinfecting Water with Iodine

One drop of ordinary tincture of iodine, of 7-per-cent strength, is sufficient to thoroughly disinfect a quart of water, according to federal chemists. Water treated in this way is safe for drinking purposes in most cases. After the iodine has been added and mixed, the water should be set aside at least 30 minutes before it is used. For a pailful of water, which equals 2¾ gal., add 11 drops of iodine.

¶Kerosene is a good lubricant for reamers used in aluminum.

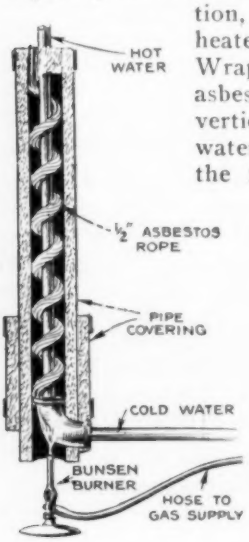
Stick Suspended Across Dog's Legs Breaks the Habit of Chasing Cars

Stick Cures Dogs That Chase Cars

One of the most annoying habits of dogs is to chase cars. To effectively cure them of doing this, suspend a light spruce stick from the collar as shown in the illustration. When the dog is running, the stick hits against its knees so that it soon will stop. This remedy has been used with success, is no cruelty to the dog, and will, in fact, prevent many accidents into which the habit may lead it.—William F. Porter, Red Deer, Can.

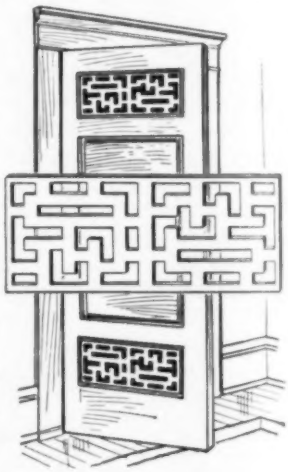
Improvised Hot-Water Heater

When small quantities of hot water are required, and the furnace is not in operation, an effective water heater can be improvised. Wrap 10 turns of ½-in. asbestos cord around the vertical section of hot-water pipe leading from the furnace, the lowest coil of the wrapping being just above the elbow of the pipe, as shown in the illustration. Continue the wrapping for about 30 in. and then slip a 36-in. length of asbestos pipe covering over it, the latter being a snug fit over the wrapping so that heat applied at the bottom will rise spirally and therefore be more effective in heating the pipe. One coil of the rope plugs the space at the top between pipe and covering and a clamp is then used to hold the covering in place. Flutes through the upper coil allow the escape of warm air. A Bunsen burner is set in a convenient position under the elbow to furnish heat.—Otto Emmert, Denver, Colo.



Ventilating the Closet

Proper ventilation of clothes closets is often a problem, especially in older houses. It is usually impractical to provide a vent in the ceiling, and this method also has certain disadvantages in cold weather. However, ventilation can readily be obtained by providing grillwork in the closet door as shown in the drawing. Get some plywood and cut it to the size of the top and bottom door panels so that it can be substituted for these as indicated. The plywood panels can be cut out according to any suitable design with a jigsaw or fretsaw. In addition to the ventilation obtained in this way, the appearance of the door is greatly improved, and the grills may be removed any time.—Hi Sibley, Pasadena, Calif.



How to Get Hose on a Tight Fitting

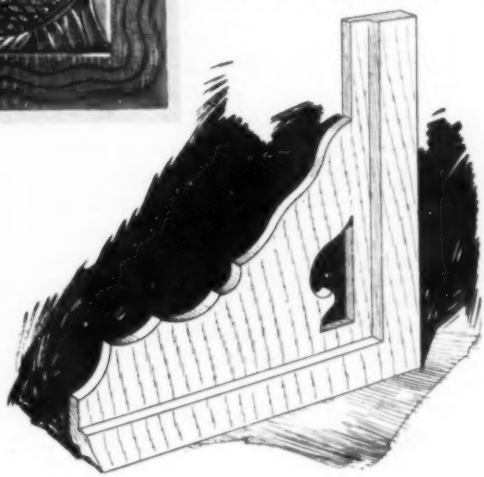
When it is difficult to get the end of a garden hose on a coupling, dipping the hose in gasoline will help considerably. The gasoline reduces the friction and also causes the rubber to swell slightly. As the gasoline dries out quickly, no harm will be done to the hose. The same method can be followed when installing automobile radiator hose.—C. E. Packer, Chicago.

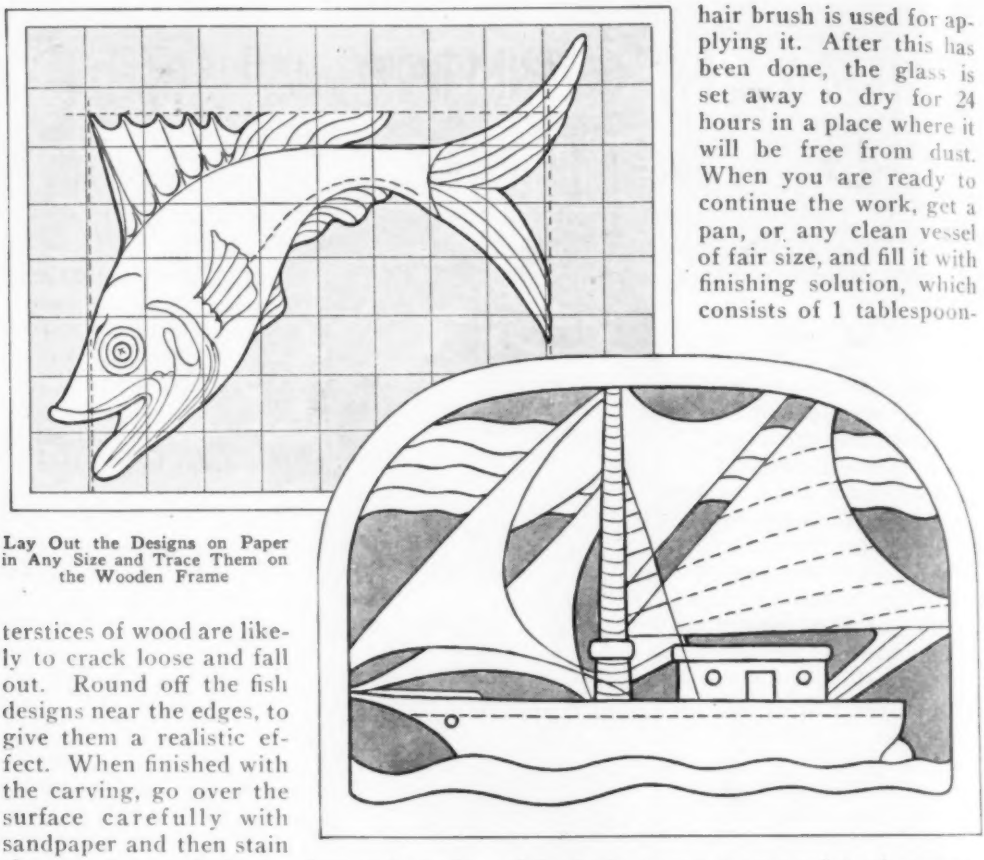
TRANSFORMING AN OLD MIRROR

by TUD KEMPF

BEFORE throwing away that old mirror look at the accompanying photos and illustrations to see some novel homemade and hand-carved frames, which are not only interesting to make but also help to give your home that touch of individuality that cannot be duplicated by any commercial product. Any mirror will do for the purpose, provided the silvered surface is still in good condition. Do not use a glass with tarnished, flecked and spotted silver, or you will run the risk of having a better frame than glass, which would, of course, not do justice to your workmanship. Plate glass is preferable to ordinary thin glass, as it is free from many imperfections found in the latter.

Although any desired design can be used, the ship-and-fish design shown here is rather easy to work out and makes an attractive job. For your convenience, the fish is laid off on squares, which you can duplicate in larger proportions. A single ¾-in. piece of wood of the required size to cover the mirror is obtained. In this case, sugar pine was used, because it is easy to work and does not split readily. However, mahogany is an excellent wood to carve and there are many other varieties which are equally suitable. Pick out a piece that is free from knots and is nicely grained, although a knot hole, as shown in the photo, may appeal to some as being more artistic in this particular kind of ornament. Use a piece of carbon paper for tracing the design, which is first laid out on paper. Then proceed with the cutting of the holes, using a drill and a keyhole saw. The edges are scraped smooth and then sandpapered, after which the carving is done. Any handy knife can be used for this purpose, but most workers will find an ordinary jackknife convenient. Care must be taken not to cut cross lines too deep, or the in-





Lay Out the Designs on Paper in Any Size and Trace Them on the Wooden Frame

terstices of wood are likely to crack loose and fall out. Round off the fish designs near the edges, to give them a realistic effect. When finished with the carving, go over the surface carefully with sandpaper and then stain the wood any desired color and shade, after which shellac or varnish can be applied. Rub the finish down with powdered rottenstone and oil in order to eliminate the luster, as a dull satin finish is preferable for work of this kind.

Roman Crystallotype Painting

You can produce some really attractive imitation Roman crystallotype paintings by following the instructions given in this article. First get a picture, choosing the cheapest sort of colored print, and cut the margin down to the colors. A magazine cover will do nicely for the purpose. Next, get a piece of common window glass. It should be clear and free from blemishes. Cut it down to the size of the picture desired. See that the glass is clean, and then give one side a smooth coat of crystallotype varnish, which is composed of 1 oz. of fir balsam and ½ oz. of spirits of turpentine. A flat camel's-hair brush is used for applying it. After this has been done, the glass is set away to dry for 24 hours in a place where it will be free from dust. When you are ready to continue the work, get a pan, or any clean vessel of fair size, and fill it with finishing solution, which consists of 1 tablespoonful of vinegar, 1 teaspoonful of common salt and 1 qt. of water. This liquid serves to set the colors. Varnish the glass the second time on the same side, with the same varnish as before, and then dip the picture in the finishing solution, being careful to see that it is entirely submerged. Keep the picture face up, and let it remain that way for a moment or two, until it is thoroughly saturated. Then remove it carefully and place it, face up, on a newspaper. Left in this manner for a short time, the top side will soon dry off, but the underside will still remain damp. As soon as the solution disappears from the face of the picture, you are ready to proceed. Place the picture, face down, on the varnished side of the glass, being careful to get it on evenly. Press it down firmly to exclude all wrinkles and bubbles. This is quite important, for any air between the picture and the glass will mar the finished product. While the picture is still damp, rub the paper from the back

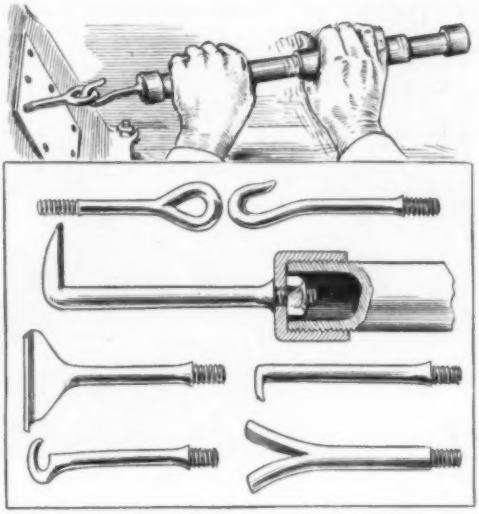
side until you get it sufficiently thin to see the outlines of the print, taking care not to rub through into the glass. Get the surface of the paper as even as possible and smooth it off with a piece of very fine sandpaper. Finally, give the back a heavy coating of varnish and place the picture away to dry in a dustless, airy place. If any white spots show up, just give the surface another coat of varnish, and they will disappear. When the picture is absolutely dry, take a sheet of colored paper—any color you desire—and use it as a background. Exposing one face of the picture will give you an imitation oil painting, while the other side will give the effect of a crayon sketch. You can experiment with backgrounds and pictures until you get what you like best. Properly framed, these pictures make highly attractive wall decorations for the home.—Geo. Pommer, Jr., Minneapolis, Minn.

Old Auto Frames Used as Bridges

Old auto frames, which cost very little, make sturdy stock bridges over small creeks on the farm. Cement blocks on either side provide the footing for the bridge, and 2-in. planks, laid crosswise, form the floor. The floorboards are bound together by 2 by 4-in. stringers along the edges, as shown, nailed down securely. Holes are drilled through the planking over the holes in the frame so that bolts can be used to bind the assembly together. These bridges have been found heavy enough to withstand ordinary pasture

Improvised Pasture Bridges Made from Old Auto Frames Are Cheap and Sturdy

floods.—George R. Harrison, Council Bluffs, Iowa.



Reverse Hammer, Made from Pipe Fittings, Will Be Found Useful for Many Purposes

Reverse Hammer Has Many Uses

Many workmen often feel the need of a reverse hammer, that is, one that exerts a pull by jarring it backward. The one shown in the drawing is made up almost entirely of pipe fittings and is equipped with a number of interchangeable hooks adaptable to all kinds of work. The body of the tool consists of a pipe nipple, 12 or 18 in. in length, fitted at each end with a cap. A 6-in. sleeve, fitting rather loosely on this nipple, but restrained from coming off by the caps, provides the driving power by being struck sharply against the rear cap. The front cap is drilled, the hole is tapped to receive the threaded ends of the hooks, and a nut is provided on the inside to prevent stripping the thread in the cap. Modifications in the size of this tool depend on the use for which it is desired. Uses for such reverse hammers extend from the watchmaker's trade to the heaviest kind of engine work in ships and power houses.—J. E. Hoag, Alhambra, Calif.

Painted Revolver Sights Aid Vision

Skill at target shooting with pistols is materially increased by improving the visibility of the sights. This can be done by painting the front one white and the rear one red, according to a champion pistol marksman of the police force at Ogden, Utah.—Glen Perrins, Ogden, Utah.

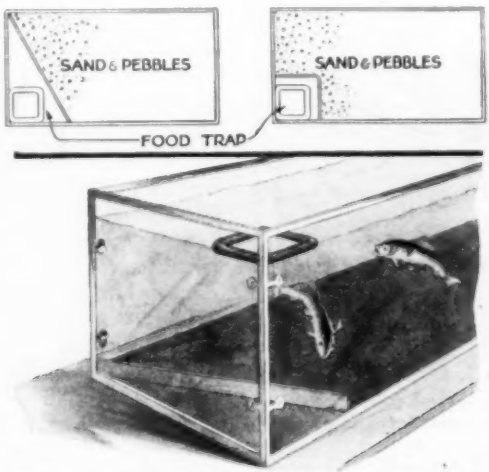
This Ornamental Bumper for Car Is Made from Old Airplane Propeller and Serves the Purpose Well

Old Propeller Makes Ornamental Bumper

Being thoroughly "air-minded," this young aviatrix even installs airplane fittings on her car. An old propeller, no longer useful for its original purpose, was substituted for the front bumper, bolts being used to attach the blades to the extending brackets.—Edwin G. Stephan, Detroit, Mich.

Food Trap for the Aquarium

In aquaria, whether of the balanced or unbalanced kind, great care must be taken that the water does not become sour, acid or otherwise unfit for the fish. The main cause of polluted water is the uneaten fish food, which, settling to the bottom of the tank, drops between the pebbles or mixes with the sand. This unconsumed food, even though it remains in the water only a few hours, decays and endangers the health of the fish. Glass-tube rings, which float on the water, are good for keeping the food from floating all over the water, but do not prevent the food from settling to the bottom. In order to keep the food out of the pebbles and sand, a food trap of the kind shown in the drawing should be used. The trap is made simply by taking a strip of glass, about ½ in. longer than the short side of the tank and as wide as the depth of the pebbles and sand. The strip is placed edge up so that one end of it rests in one corner of the bottom and the other end butts against the opposite side, as indicated. This arrangement divides the bottom into two sections, the smaller one of which is the trap. The strip is held in place by the pebbles and sand against one side. It may also be bent to a right angle as shown in the right-hand sketch. The floating food ring must always be directly over the food trap, when food is dropped into it. Usually the ring will remain in its position due to the cohesion between it and the side. All the food that settles to the bottom of the trap and is not eaten, can be siphoned out without any trouble. It is also a good idea to round off the upper edges of the glass strip on an emery wheel so the fish will not get hurt by bumping against it. This food trap has been used by a breeder and seller of fancy fish.—Walter C. Michel, Jersey City, N. J.



This Arrangement Provides a Food Trap Which Prevents Polluted Water

Removing Shellac from Brushes

Shellac can be removed from brushes without trouble in the following way: Immediately after finishing the job, clean the brush out in ammonia, lye water, sal-soda solution or even borax. The main thing is to clean the brush well before the shellac dries hard.

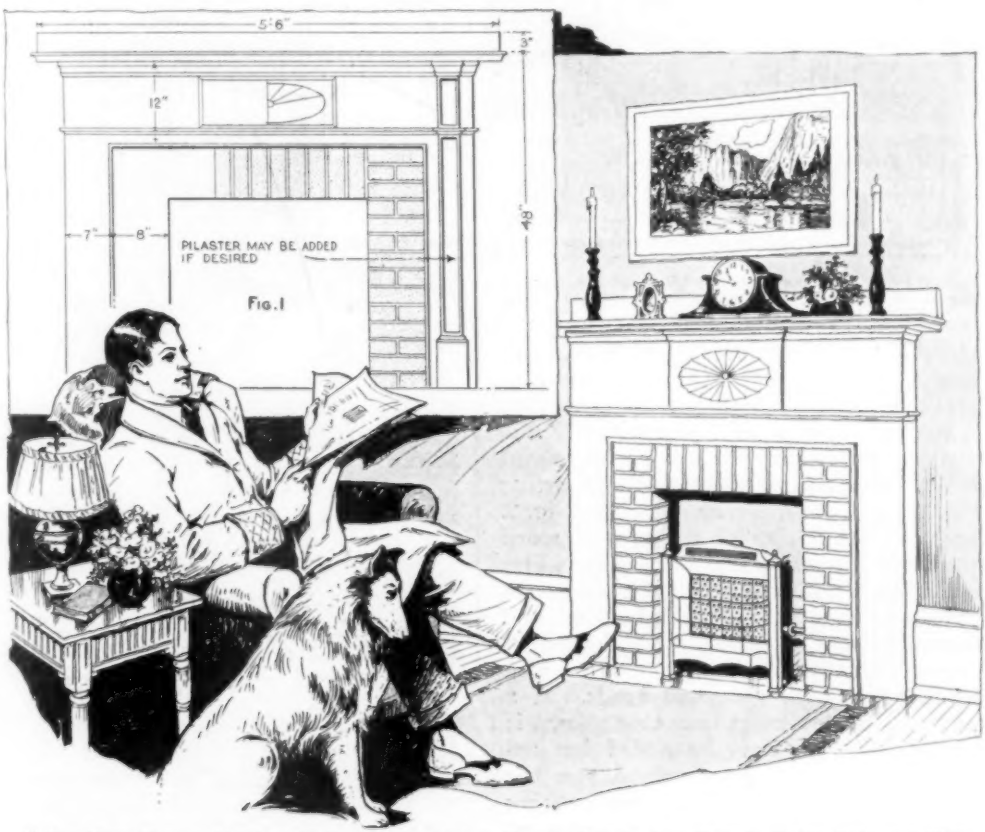
SHOP NOTES

How to Build a Portable Fireplace

By E. E. SCOTT

FIREPLACES are usually considered a luxury, and the high cost of brickwork and ashpit foundations has forced many a home builder to reluctantly omit this much desired feature from his plans. However, a substitute, which closely resembles a real fireplace, is the portable one shown in the photos and drawings. It even includes the "brickwork" and it can be moved from room to room or house to house without any difficulty. Furthermore, it is easy to make, which puts it within the reach of nearly everyone.

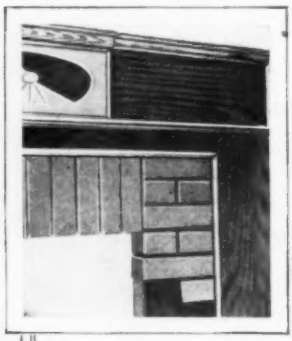
It consists of a mantel made of pine or other soft wood and a gas heater of either the radiant or imitation-log type. Al-

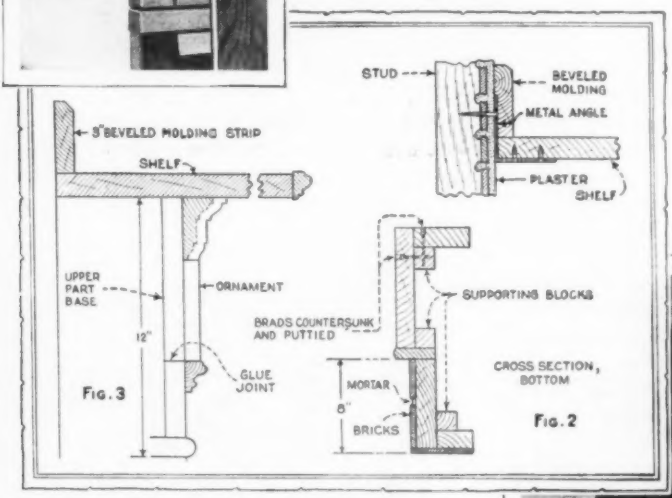


If You Must Have a Fireplace in Your Apartment or House, Here Is One That Is Easily Built and That You Can Take with You When You Move

though preferable, a flue connection is not necessary.

The mantel should be of approximately the dimensions given in Fig. 1, but may be proportionately larger if it is to be installed against a large wall space. About 25 feet of 8 by ¾-in. stock and 12 ft. each of several kinds of fireplace molding should be obtained from a building-supply house. First make a U-shaped piece to serve as a base for the built-up design. Attach sidepieces of approximately the depth of the heater which is usually about 6 in., reinforcing them with supporting blocks at the corners, as shown in Fig. 2. Lay out the design of the central motif and build it up with individual pieces, first outlining it with cove molding. Separate parts of the design should be filed and sanded smooth, then bradded and glued in place. The various moldings should also be fastened with glue and brads. If a more elaborate design than that shown is desired, pilasters may be added but accurate mitering is required to run the molding up over them. The fire opening is boxed in with a 1-in. strip, rounded on the outer edge.





Above, Photo Showing How the "Bricks" Are Laid on the Backing; Right, the Fireplace in Winter, with Heater in Place

The brickwork consists of pieces of wallboard, some cut 2½ by 8 in. and some 2½ by 4 in., to correspond to the long and short sides of tapestry brick. The bricks are laid out on a base of ¾-in. stock, which is securely attached to the back of the mantel and projects 8 in. on all sides, as indicated in the cross section Fig. 2. Hold the bricks in place with brads, arranging them like regular brickwork and allowing ⅜ in. for mortar. Fill in these joints with patching plaster, preferably using a molders' slick, although an old spoon flattened and filed to a rounded point will do. No plaster should be used until all hammering is finished, otherwise it is likely to crack. Sandpaper off the surplus plaster after it is well set and countersink and putty all nails in the woodwork.

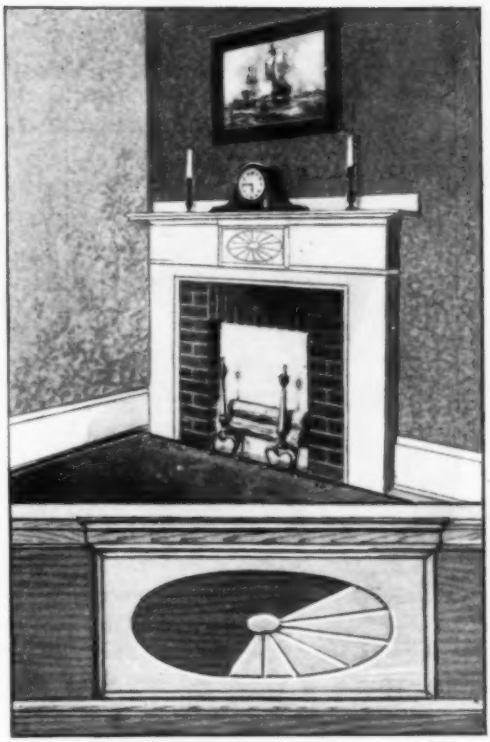
Two coats of flat white, followed by a finish coat of eggshell gloss enamel, to match the woodwork of the house, should then be applied, sanding lightly between each coat. The bricks should be painted with dark-red iron-oxide roofing paint.

which will dry perfectly flat and lusterless like real brickwork. A very pleasing effect may be obtained by mixing some blue with the roof paint and some lighter red with another batch and alternating the three shades obtained. The finished brickwork can then hardly be told from tapestry brick. The mortar should be painted a steel-gray, to resemble the mortar ordinarily used for fireplaces, which consists of the usual white variety into which has been stirred a quantity of lampblack.

To attach the finished mantel to the wall, use three angles as shown in Fig. 2. It is not necessary that the screws enter the stud under the plaster, as a lath will give sufficient support. The metal angles are concealed by the beveled molding at the back edge of the mantel shelf. This molding is added after the mantel is in place. The wall space within the line of the brickwork should be covered with a piece of wallboard to give a more finished effect. Around the base of the mantel should be placed the usual quarter-round to match that at the baseboard of the room.

If no gas lines are in place, a plumber can deftly run the required ¼-in. pipe between the partitions and under the floors as required.

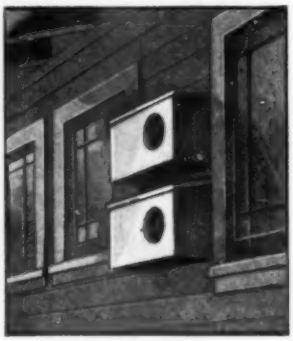
During the summer, while no heat is required, a pair of andirons with short fuel supports may be set in place to carry a few birch logs.



The Fireplace in Summer, with Logs and Andirons, and How the Ornament Is Built Up

Installing Electric Meters Outdoors

At San Diego, many residences have the electric meters installed outdoors, in suitable boxes to protect them from the weather, so that meter readers need not bother the occupants, and never have to make a second trip. The boxes have a round opening fitted with glass, directly over the meter, and are attached to the wall by means of angle brackets, or they may be built right onto the wall and provided with a hinged front. It is an easy job to make an installation of this kind, even in an old house.—Dale R. Van Horn, Lincoln, Nebr.



Flux for Soldering Tin Roof

When rosin is used as a flux for soldering a tin roof, some of it flows out of the seam and onto the surface of the tin which is to be painted. In a short time, the paint will peel off this spot, leaving the metal exposed. If acid flux is used, such as chloride of zinc, it will corrode the tin in places and rusty spots will appear. Both of these objections can be overcome by using ordinary boiled linseed oil as a flux. It is very easy to apply and excessive oil on the surface of the tin will protect it instead of injuring it.—James H. Beebee, Rochester, New York.

Portable Shelf Attached to Barrel

For grocers, and others who occasionally have to fill bags from barrels, the

Small Shelf Hooked to Edge of Barrel Saves Effort in Filling Bags

portable shelf shown in the drawing is highly convenient. It consists of two lengths of flat iron, bent at right angles and attached to a small board. The upper ends of the brackets are bent over to form hooks which are slipped over the edge of the barrel. The use of the shelf is apparent as well as the amount of stooping that it eliminates.

Cementing Glass to Metal

For cementing glass to metal, a mixture of sodium silicate and quartz meal, baked 12 to 24 hours to set hard, is recommended. If the color is unimportant, a useful preparation may be obtained by soaking leather-scrap glue in water, melting it by heat and then mixing it with 11 lb. of pitch, 4½ lb. of asphaltum and 4½ lb. of rosin to each 1¾ lb. of glue solution. The mass may be loaded with powdered slate, etc., without losing its adhesive properties. Casein cement for immediate use is made by mixing fresh curds with one-fourth its weight of powdered chalk; while a second preparation, which will keep, consists of a solution of casein in ammonia, or of a solution of the same material in a 5-per-cent solution of caustic soda or borax, with the addition of a very small proportion of hexamethylene-tetramine. This cement is impervious to water. Rosin adhesives are also used, the "amber" cement employed by jewelers being composed of three parts of mastic and two to four parts of shellac, dissolved to a "sirup" in 90-per-cent alcohol.

Wooden Core Strengthens Pipe Nipples

Old pipe nipples, particularly those used for steam and water, are often very thin and should be protected by means of a wooden core when it is necessary to remove them with a pipe wrench. Whittle down a long tapering plug and drive it into the nipple. The wrench is applied at the point where the plug fits snugly. In this way, one can easily prevent the pipe from being crushed and bent.

Wheelbarrow Track on Cleated Incline

When running heavily loaded wheelbarrows up or down steep inclines, it is often necessary to provide cleats on the incline in order to prevent the workmen from slipping. A plank is laid over the cleats to serve as the barrow track, but difficulty is sometimes experienced in the barrow slipping off. To prevent this, use a length of channel iron instead of a plank. The barrow can then be pushed up without even looking at the track.—Jos. C. Coyle, Englewood, Colo.

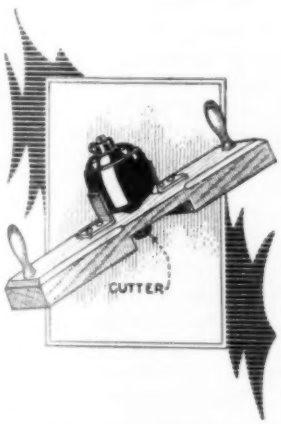
Length of Channel Iron Laid on Cleated Runway Guides Wheelbarrow

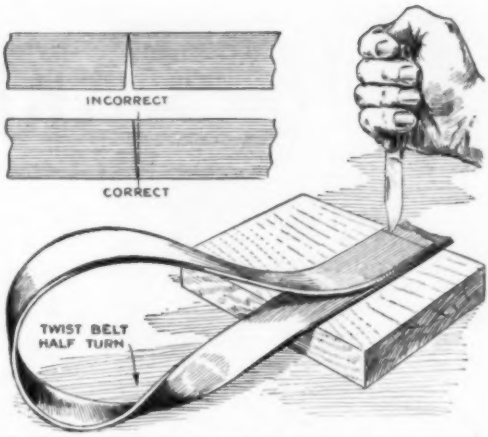
Bandsawing Inside Diameters of Rings

With the ordinary use of a bandsaw, it is impossible to saw out an inside diameter without cutting a path from the outside, which is usually not desired. In the case of large rings used in pattern shops, it was found convenient to slip the entire ring over the top of a small bandsaw and it was then an easy matter to saw the inside diameter without making a cut through the ring.—Alexander Forsyth, Hartford, Conn.

Cutter for the Woodworking Shop

Wherever there is need for a quick and accurate cutter for lining up internal and external members on a curved or warped surface, the marker illustrated will be a distinct advantage. It can be used in boat building for trimming down stringers, etc., to line up with the keel and chine; in automobile-body work; in furniture work, and, in fact, it will be found useful in practically any shop. Without it, the worker must keep lining up with a straightedge and planing off a little on the interior members, checking back with the straightedge, and then planing some more. This cutter will actually plane off the wood along the top of each stringer or internal member in turn, producing an absolutely accurate and true surface, with no interruptions to the operation for lining up. It is made by mounting a small electric motor, such as is used for drills, on a straight piece of wood of convenient length. A router bit is recessed in a notch in the under side of the straightedge so that it comes flush with the bottom. The hole through the straightedge should be bushed with a free-fitting metal tube. Knobs may be added in the ends for convenience.





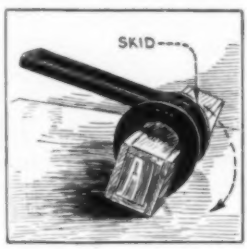
Cutting Both Ends of a Belt at the Same Time Insures Accuracy of Joining Line

Joining the Ends of Belting

Although it is not absolutely essential to have the joining ends of belting cut perfectly square to the sides, as shown by the dotted line in the drawing, they must butt together all the way across. If they do not, the belt will not run straight. A good method of insuring accuracy is to give the belt a half twist, bringing the ends together over a block, after which a knife is used to make a clean cut through both ends at the same time. In doing this, care must be taken not to shift the belt.

Skid for Heavy Boxes

In a manufacturing plant where the goods were packed in smooth boxes of uniform size, and the handling of these boxes was rather awkward, owing to their weight, the skid shown in the illustration was found useful. It consists of two U-shaped pieces, with the outsides rounded, the gaps of which fit the boxes. These pieces are riveted to a strip of ¼-in. flat iron used as a handle. The skid is slipped over the box and the whole is turned over by means of the handle, so that the skid can be dragged over the floor. The underside of the runners are rounded to make this easier.—Harry Moore, Hamilton, Canada.



MAKING A SMALL

by Clyde Lammey

THE DRUM TABLE shown in the accompanying illustrations offers an excellent exercise in wood bending, one kind of woodworking seldom attempted in the home shop. In this instance, the top and bent parts were of quartered oak and the base of plain sawed stock, although walnut or mahogany may be used equally well.

The column, Fig. 1, is built up of three pieces of 13/16-in. stock, 3¼ by 20 in., glued to form a square piece. Square the ends and turn to a 3-in. cylinder, then turn the dowel at the top 1 in. in diameter and ⅞ in. long. Lay off the divisions with a pencil and turn to the shape and dimensions given in Fig. 1. Lay out the legs on plain 1¼-in. oak, saw to shape and sand the edges well. Note particularly the direction of the grain in Fig 1.

The top is glued up from three pieces, ½ by 8 by 20 in. On both long edges of one piece, a ⅛ by 5/8-in. groove is run, and on one edge of each of the other two, a ⅛ by 9/16-in. tongue. Make the joints an easy fit, then glue and clamp. Make up a bottom framework, as shown at the left in Fig. 2, from two pieces ½ by 6 by 20 in. and two pieces ½ by 6 by 13 in. Cut tongues on the ends of the short pieces, ⅛ by 7/16 in., and glue into ⅛ by ½-in. grooves in the longer pieces, to make a frame 20 in. square.

The curved pieces forming the drum are set into grooves cut in the top of the bottom frame and the underside of the table top. To mark the groove in the bottom frame, make up the rig shown in Fig. 2. Nail a scrap piece of wood across the bottom of the frame and on top of this a ½-in. block. Piece A, which forms the trammel for striking the circles, has a small nail driven through one end, and, 9¼ in. from this, a ⅛-in. hole is drilled, at C. Mark the center of the frame on the block, drive

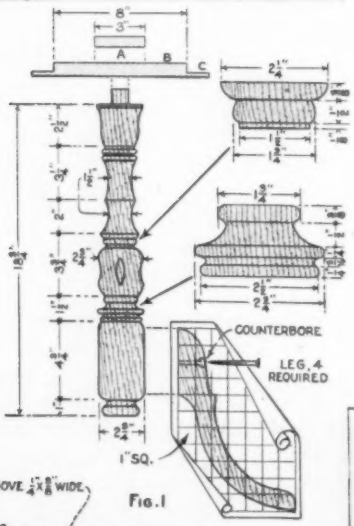


Fig. 1

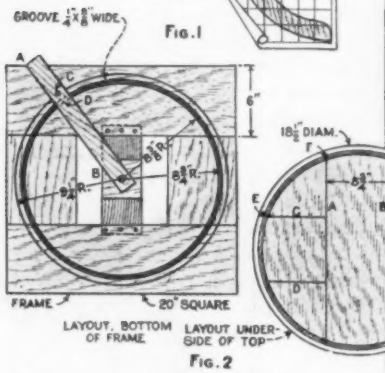


Fig. 2

Top, the Completed Table, with Fluted Column and Reeded Legs; Bottom, Screwing a Leg to the Column

DRUM TABLE

the nail into this mark, and, with a pencil through the hole in the bar, strike the circle which marks the edge of the top. Make two marks on the bar, 8⅜ and 8¾ in. from the center, stick the point of a sharp knife through the bar exactly on one mark and swing the bar around so that the knife point will scribe a circle on the wood. Do the same on the other mark, and the two knife cuts mark the groove in the frame. Mark out the underside of the table top in exactly the same manner, using the same trammel. Before sawing out, clamp the work on the bench and rout out the grooves. Take cuts only 1/16 in. deep at one time and work entirely around the groove before taking another 1/16-in. cut. The grooves are cut ¼ in. deep. Saw the two pieces to the circle marking the outside diameter and sand the edges thoroughly, rounding them slightly.

For the bent work, use two pieces ⅜ by 3½ by 36 in. Measuring ¼ in. from the edge, rout a ¼ by ¼-in. groove on the face of one of the pieces. In this bending job, no steaming is necessary, and the work may be done over a gas plate or similar flame. The wood must be heated to a point just short of scorching before it will bend readily.

The preliminary bending of the two pieces is done by simply taking hold of the piece at both ends, holding the center of the piece over the heat and applying a bending pressure by slowly pulling the ends together. Remember that the wood bends only at that point where the heat strikes, so that, when held in this manner, it must be moved back and forth over the heat in order to make the curve uniform.

This simple method will serve to start the bend, but it must be brought to a uniform arc by a more positive means. Fig. 3 shows a caul made from four thicknesses of pine stock nailed together. The arc of the caul is sawed to a slightly smaller radius than the arc required. Triangular

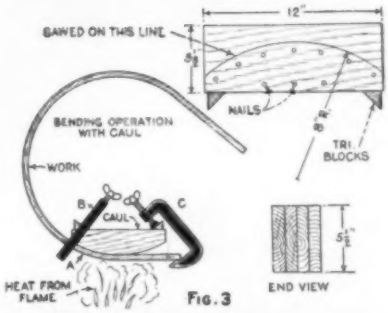
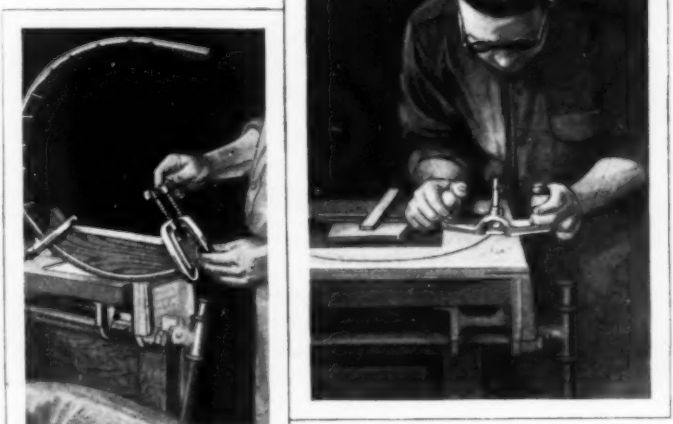


FIG. 3



Top, Scribing the Groove; Bottom, Right, Cutting Groove with Router; Left, Clamping the Wood to the Caul

blocks are nailed securely at the ends as shown. Place this caul with the curved face next to the inside of the work and at the point A in Fig. 3. By the first preliminary operation the piece can only be bent to approximately the form shown, and to make the required number of pieces with as little waste as possible, the arc must be made uniform clear to the ends.

The single clamp at B, Fig. 3, is placed first and drawn tight; those at C are only drawn sufficiently tight to stay in place. It is better to use two small clamps at C. Hold over the stove, allowing the heat to strike only the portion to be bent. Draw the two clamps up slowly and uniformly until the wood is tight against the caul. It is necessary to be very careful in this operation for, owing to the short arc, the wood may splinter if drawn too tightly against the caul before it is thoroughly heated. When the wood has been bent to the arc of the caul, allow it to cool before releasing the clamps. Continue the operation to the end, moving the caul about two-thirds its length each time. Do the same with both pieces. Once bent to the required arc, the pieces will retain their shape indefinitely provided they are not exposed to excessive moisture or heat.

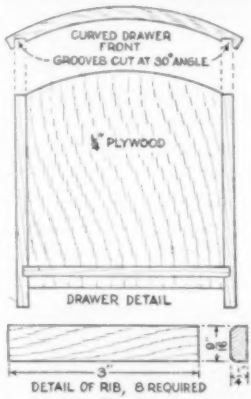


Fig. 4

Table Top with Segments Glued and Clamped in Place in the Groove in the Underside

Strike the line AB, CD on the underside of the table top, Fig. 2, equidistant from center lines drawn at right angles. Lay aside the curved piece which was grooved, to be used later for the drawer fronts, and cut the other into four segments, each of the length EF, Fig. 2. Be careful to cut each segment individually to fit, and cut the ends at an angle parallel with the lines AB and CD. Spread glue in the groove and clamp the four curved pieces in place, making sure that each piece is forced into the bottom of the groove before allowing to dry. For the drawer guides, first cut two pieces from ⅝-in. stock to 16-in. length and rip to exactly 3-in. width. Set these along the lines A and B, Fig. 2, mark for length and cut the ends at an angle to fit the ends of the segments with the outer edge of the piece on the line A; the second piece along the line B. Counterbore, glue, and fasten the pieces with short screws. The four shorter guides are ripped to the same width and fitted in the same manner along the lines C and D. The position of these guides will be readily seen from one of the photos.

Spread glue in the groove on the bottom framework. Set the drawer guides square with the opening in the lower frame and clamp the parts together, making sure that the segments are forced tightly into the groove. Drive screws through from the bottom into the guides. Fill the exposed portions of the groove with plastic wood level with the surface and, when dry, smooth with a fine rasp.

Rip the drawer sides from ⅜-in. plywood to 3-in. width and cut to 6-in. length. Cut the bottoms to 5½-in. width and 5¾-in. length, and round one end of each to the same curve as the drawer front. Run grooves, ¼ in. wide and ⅛ in. deep, in the sides, to take the bottom and back. Cut the curved drawer fronts from the bent and grooved piece, allowing about ¼ in. over the actual measurement of the opening it is to fit, as in Fig. 4. Set the dado head to cut

Left, Underside of Top with Drawer Guides in Place; Right, Screwing the Bottom Frame to the Guides

a groove, 3/8 in. wide and about 1/2 in. deep. Mark the outer edges of the grooves the same as the width of the drawer, or 5¾ in., and then set the piece against the crosscut guide with the convex side up. Bring the outside cutter of the dado exactly to the line. In this way the groove is cut to the correct angle. Hold the piece firmly against the guide when running the grooves. Assemble the drawers with glue and clamps. When dry trim the front and sides to fit in the individual openings. Tack a strip to the side of the two long guides to act as a stop for the two drawers fitting in these openings.

The beading and hollow fluting on the column and legs, as shown in the photo of the finished piece, is optional. The base looks very well when left plain, with the edges of the legs simply rounded and sanded very smooth. However, this work is easily done with a gouge, should it be desired.

Counterbore each leg for a single large screw, as shown in Fig. 1. Hollow the joining end of each leg on the sand drum or with a wide sweep gouge to fit the column. Lock each leg in place with a large screw, using glue on the joining surfaces and being careful to get the legs equidistant around the column. Fill the holes with plastic wood, and, when dry, sand smooth. The legs may be doweled and clamped over glue where time is not a consideration, though the method described defaces the work so very little that the saving in time is worth while.

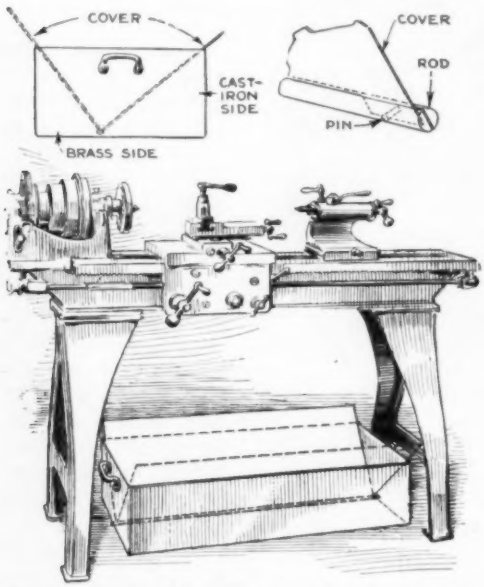
Cut the piece B in Fig. 1 to 10-in. length and rip to 8-in. width. Locate the exact center and bore a 1-in. hole. Saw the piece A to 3-in. diameter. Cut rabbets at the ends of piece B 1 in. wide and 5/8 in. deep, as shown at C. Set this over the column dowel and drive down tight on shoulder; then trim the projecting end of the dowel flush with the surface. Bore a small hole at the center of the circular piece C, and screw it to the end of the dowel. Set the table top in place, with the inner edges of the lower frame set on the rabbets in the ends of the piece B. Drive small screws into the lower frame at the rabbets. This assembly allows the table top to be turned on the column. Round off the edge of a length of 9/16-in. stock and rip off a strip 1/4 in. thick. Cut this into eight pieces, each 3 in. long, and nail these at each side of each drawer to form the "ribs" of the drum top. Use small brads and set in the heads.

If quartered oak is the wood used, first stain the wood lightly with silver-gray stain. Sand lightly and fill with white lead, reducing the lead to a paste with turpentine. Rub off with a coarse cloth until only the grain shows light. Allow

to dry and give two coats of flat varnish. Rub with rottenstone and oil to a smooth finish. If walnut, sand and fill the wood, stain and allow to dry, then sand lightly and give the two coats of flat varnish. Polish in the same manner as described above. Fasten small brass or bronze pulls on each of the drawer fronts.

Double-Purpose Cutting Pan

Only the larger shops possess magnetic machines for separating brass and cast-iron cuttings and consequently, when a lathe is used for working both materials in a small shop, the space beneath the lathe, and the pan or box used to catch the cuttings, must be cleaned each time a change is made. The time consumed in doing this can be saved by using the novel pan shown in the drawing, the cover of which, being hinged at the bottom, forms two compartments, one of which is open when the other is closed. The cover is made of a length of rod slightly longer than the pan, and a piece of sheet metal the same length as the inside. A slot is sawed in the bar at each end, and the sheet metal is cut to leave two projecting pieces to fit into these slots. The ends of the rod are drilled for pins and a hole is drilled through each end of the pan, close to the bottom, to take the rod. The parts are then assembled and the pins are driven in when the rod is in the holes in the pan. In this particular case, the rod is off center so that more space is left for cast-iron cuttings, which is the metal mostly used. The cover is tipped to one side or the other to keep the brass cuttings in one compartment and the cast-iron in the other.—Harry Moore, Hamilton, Can.



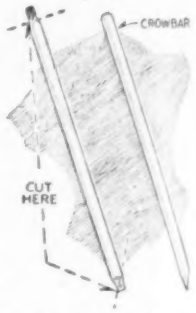
Cover of Cutting Pan, Pivoted at the Bottom, Separates Brass and Cast-Iron Cuttings

Prolonging Life of Road Maps

Paper road maps, subjected to frequent use and exposed to moisture, soon become worn out. This trouble can be remedied by mounting them on oilcloth or any rubberized fabric. Paint the back of the map and the cloth side of the oilcloth with ordinary rubber cement. Scrape all the surplus cement off, allowing only a thin film to remain. Let this dry thoroughly and then apply a second coat of cement to both surfaces. When this is dry, press the map firmly against the backing material. Starting from the center, use a short, smooth piece of wood, or preferably a roller, for pressing the map down evenly to eliminate all the wrinkles and blisters. This method is particularly useful for aviators' flight maps, which are often exposed to wind and rain. In the case of aerial strip maps, which are cut into 6½-in. strips, each covering 50 miles of ground, place them on the backing in the way just described, but separated about 3/16 in., to provide space for folding. The army air corps uses hundreds of square feet of old balloon cloth for this purpose each year.

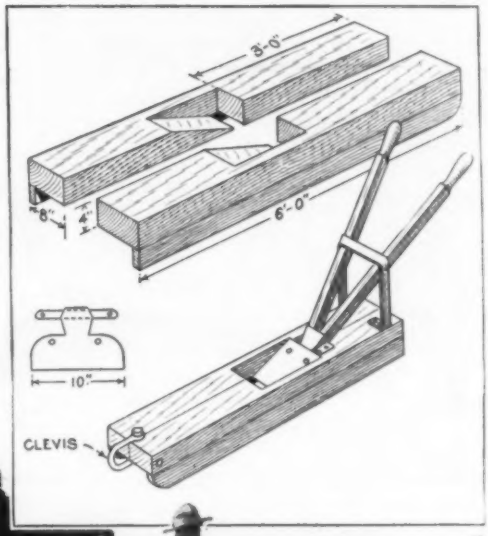
Old Driveshaft Makes Good Crowbar

A strong crowbar, which cannot be bent by the combined efforts of two men, may be made from a discarded driveshaft of a model-T Ford. The threaded end is cut off and the rough spot filed or ground down so that it will be easy on the hands, while the other end is cut off at an angle as shown.—J. A. Blaker, West Auburn, Mass.



HORSE PLANE WITH BROADAX BIT SQUARES LOGS

When we want to hew logs to shape, we save labor by making our horses provide the power for our "planing mill." The plane consists of a 4 by 8-in. by 12-ft. plank, sawn in two to make a block 6 ft. long. Each piece has a slot cut in it as shown in the drawings, and back of the slot a seat is cut to form a bed for the plane bit, which is a common broadax. The slope of the bed is made to suit the bevel of the ax, the lower bevel being almost parallel with the bottom. The planks are fastened together with three 1-in. dowels and a piece of pipe, the latter being used as a dowel at the front end. Two runners are nailed to the sides of the block to keep the "bit" off the ground when drawing the plane from one log to another.



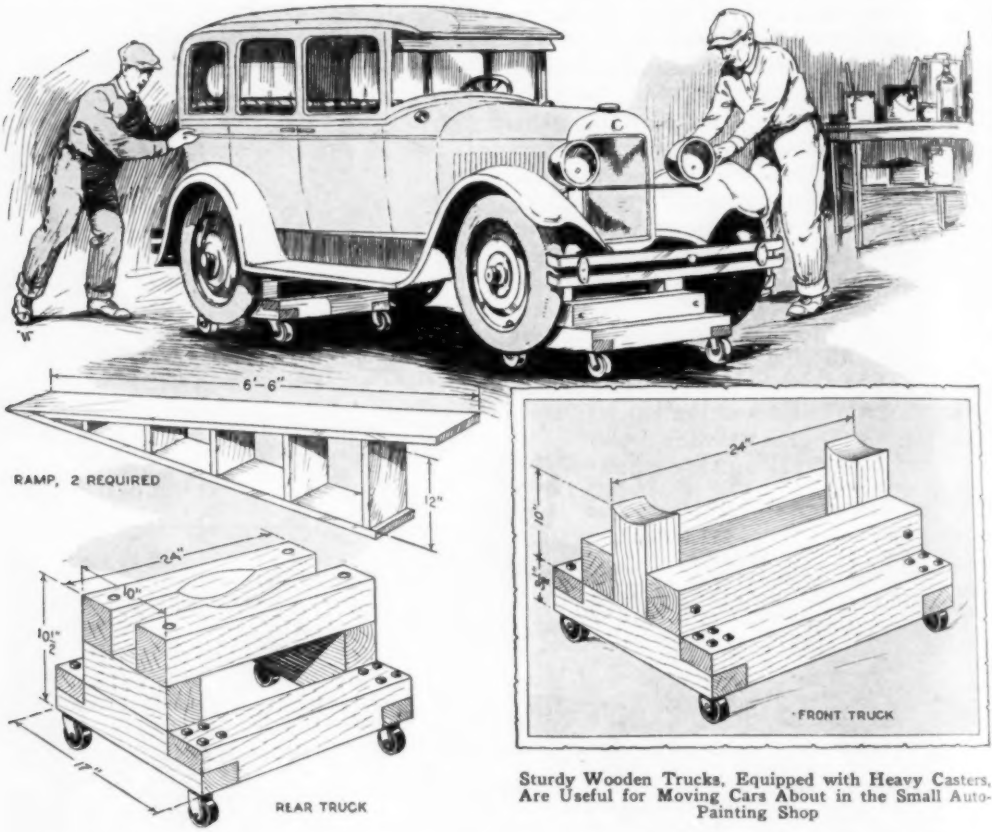
Log Plane Uses Horses as Power and Broadax as Bit; Left, Canadian Ranch House Built of Logs Hewn with the Plane

The ax is held in place with four bolts, two holes being drilled in the shoulder of the ax and a piece of ⅜ by 1-in. flat iron driven through the eye for the other two bolts. The nuts and washers are counterbored into the underside of the block.

We hew two logs at a time, running the plane down one log and then back on the other, to save time. In most cases it is necessary to set a short post in the ground in front of each log to take the thrust. The shavings should not be more than ⅜-in. thick, and, of course, the wider the blade of the ax the bigger the logs that can be handled.

Shakes can easily be made by sawing across the log. We hew from twenty to thirty logs a day, and the shavings, when dried, make excellent kindling.—Eden W. Robinson, Bear Flats, B. C.

HANDY AUTO TRUCKS FOR THE SMALL PAINT SHOP



Sturdy Wooden Trucks, Equipped with Heavy Casters, Are Useful for Moving Cars About in the Small Auto-Painting Shop

In small auto-painting shops where space is rather limited, the couple of trucks shown in the illustration will be found a great convenience. They were specially designed to move the cars about as required, when stripped of wheels and accessories, which, according to customary practice, is the first thing done before cleaning and painting the cars. After being mounted on the trucks, the cars can be moved to the wash rack, rubbing room, color-varnish room and finishing room. The constructional details of the front and rear trucks are shown in the drawing and no difficulty should be met in making them. Two ramps are also provided, as shown in the detail, so that the cars can be run on the trucks under their own power, which eliminates the necessity of using jacks. First the front wheels are partly run up the ramp until the axle is elevated far enough to permit the front truck to be placed directly under it, and then the same procedure is followed in mounting the rear axle on the other truck. Large swivel casters allow the trucks to be moved about in any direction.—E. E. Moffat, Pasadena, California.

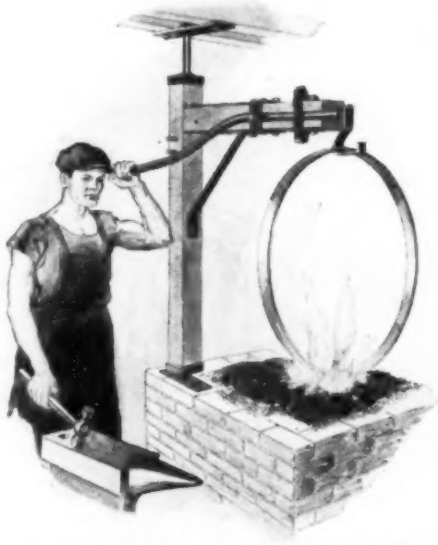
Tool for Removing Broken Axle

For removing a piece of broken rear axle from the housing, a handy tool can be made from a piece of broomstick and a 5-in. pipe nipple. The latter is slipped over the end of the broomstick so that 2 or 3 in. projects, and a hole is drilled through both to take a pin or screw to hold the assembly together. In use, the pipe end of the tool is inserted into the housing to fit over the piece of broken axle. Then the handle is brought over toward one side, which will bind the nipple on the broken piece, after which it is an easy matter to remove it. This method has been used for some time in a large

garage and has been found entirely satisfactory in practice.—Carlton Groat, The Dalles, Ore.

Blacksmiths' Crane for Heating Heavy Tires

Blacksmiths will find the illustrated crane of considerable utility for holding heavy tires in the fire. It consists of a standard and arm of 4 by 4-in. stock, mortised and fastened together at the desired height by means of a strap bolt screwed to the top of the arm and passed through the standard. A shouldered pin of ⅞-in. stock was driven into each end of the standard to provide pivots. The ends of the standard were also banded to prevent splitting. A lever for handling the crane was made of ½ by 2 by 2½-in. soft steel. A loop, to serve as a guide for the lever, was bolted to the arm, leaving a little vertical and horizontal play, to prevent the handle of the lever from catching behind the pins, which are driven into the standard for the purpose of holding the lever in place when not in use. A hook for lifting and carrying the tire is fitted to the end of the lever as indicated. The work can be moved from the fire



Blacksmiths' Crane Transfers Heavy Tires from Fire to Anvil

to the anvil and vice versa without any trouble.—Roy McLalan, Lexington, Mass.

Block of Wood Fitted with Two Handles and a Sharp-Edged Screw Makes a Good Router

Simple Homemade Router

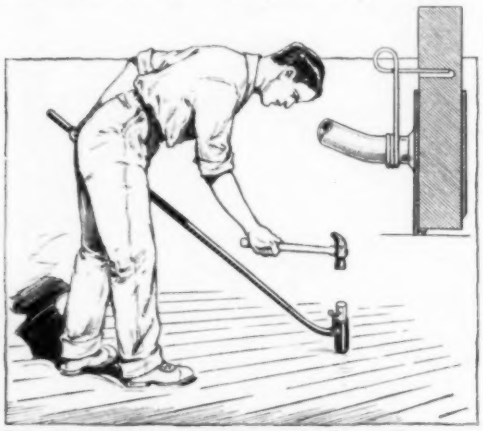
For the home mechanic who has only a few tools, the router illustrated herewith will be found convenient. It consists of a suitable oblong block of proper length, fitted with a handhold at each end and a screw on the underside, projecting the same distance as the depth of the routing. The screw head is filed to a sharp edge so that it will cut through the wood readily.—E. K. Wehry, Cedar Rapids, Iowa.

Fireproof Paint

To make a good fireproof paint, slack stone lime by putting it into a tub, covering the tub to keep in the steam. When it is slacked, pass the powder through a fine sieve and to each 6 qt. add 1 qt. of rock salt and 1 gal. of water. Then boil the mixture and skim it clean. Next, to each 5 gal. of this mixture add 1 lb. of pulverized alum, ½ lb. of pulverized copperas or copper sulphate, and after these ingredients have been mixed, add ¾ lb. of powdered potash, and 4 lb. of either very fine sand or hickory ashes. Now give it any desired color and apply it with a large brush. This paint is as durable as slate. It will stop small leaks in roofs, prevent moss growth, make bricks impervious to moisture and make any surface fireproof.—Louis Andrews, St. Louis, Mo.

Redriving Projecting Floor Nails

A nail projecting, however little, above the surface of the floor, is always danger-



This Tool Detects and Hammers Down Dangerous Projecting Nails in the Floor

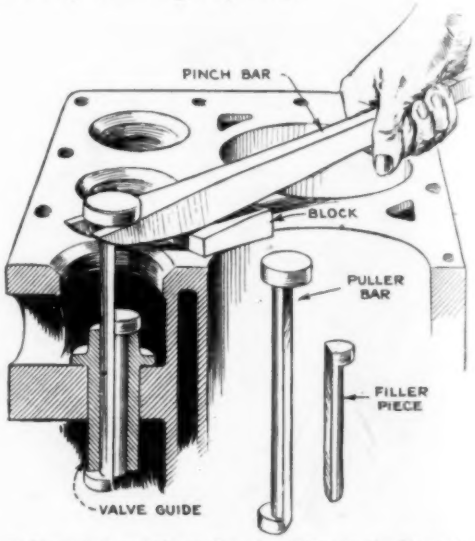
ous. Machine shops and warehouses using trucks are often troubled in this way, the vibration working up nails here and there. In one plant, a man was detailed to go around periodically to knock down any projecting nails. Accumulation of dirt around the floor joints often makes it difficult to see such nails, and for this reason a special tool was devised to locate them. It is a combination floor scraper and driver, a cross section being shown in the illustration. A projecting nail stops the scraper and one blow on the driver will send it home again. The tool consists of a vertical tube, one end of which is cut away to about half its diameter. The driver is a piece of shafting fitting loosely in the tube. A hole is drilled in the top end of the driver to take the end of a spring lifter, the coiled end of which fits snugly on the handle, which is brazed or welded to the tube. The driver is held about ⅛ in. above the floor by means of the spring.—Harry Moore, Hamilton, Can.

Cleaning Bus Exhaust-Heater Pipes

Exhaust pipes and exhaust-heater pipes often have right-angle bends, which make it impossible to clean them by means of rods and scrapers. The cleaning can be quickly done in the following way: The heater pipes are removed from the bus and filled with kerosene, which is allowed to stand in them for a short time, so that the oil may penetrate the carbon. Some wood chips are then saturated with kerosene, set on fire and inserted in one end of the pipe, after which a moderate air blast is applied to the burning wood. The carbon takes fire and the pipe will get red-hot. If there are any brazed joints, they should be kept cool with water to prevent them from loosening. It is a good idea to make an iron plug to fit the pipe and to screw the air-hose connection to this in order to force the air through the pipe. A 10-ft. pipe, badly sooted, can be cleaned in from 20 to 30 minutes in this way.—Ernest Romkee, Colorado Springs, Colorado.

Tool for Removing Valve Guides

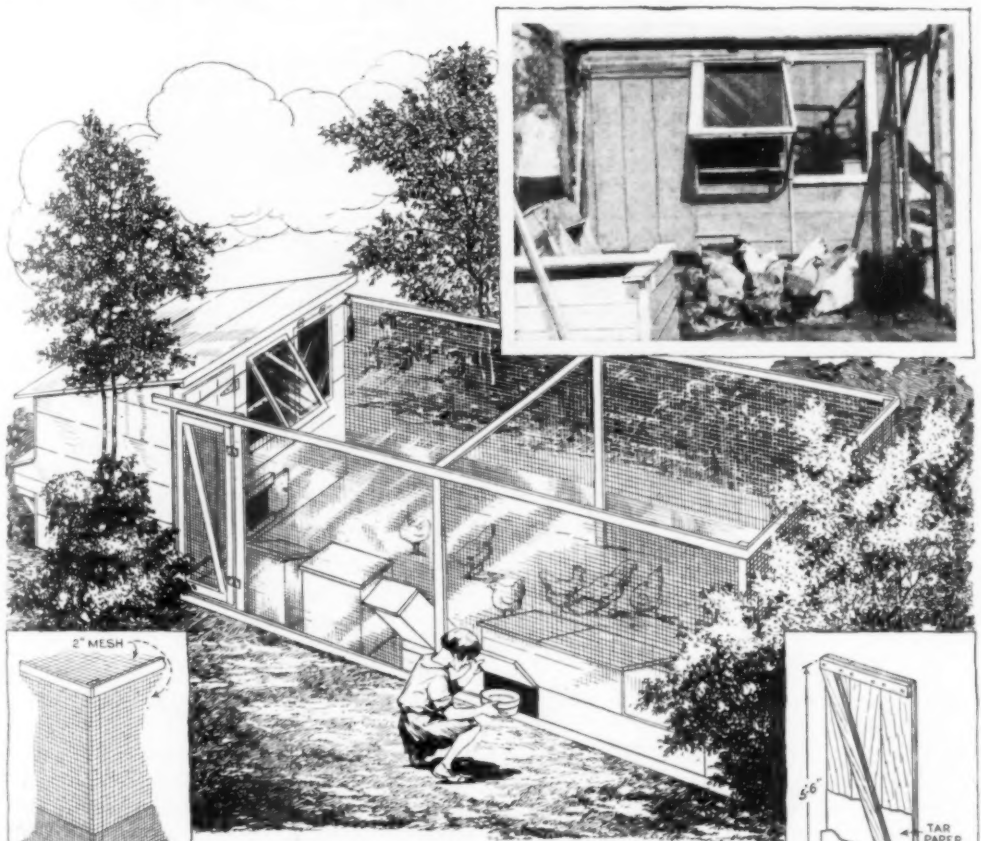
Removal of valve guides is an easy matter with the tool illustrated. It consists of a rod with an offset at the bottom, to be slipped under the valve guide as indicated, and a suitable head at the top end under which the claws of a pinch bar are pushed. A small wooden block is pushed under the bar to serve as a fulcrum and downward pressure on the bar causes the pulling rod to lift the valve guide.—G. A. Luers, Washington, D. C.

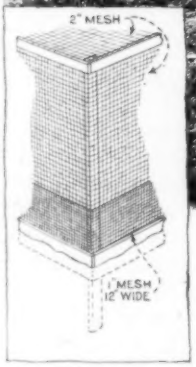


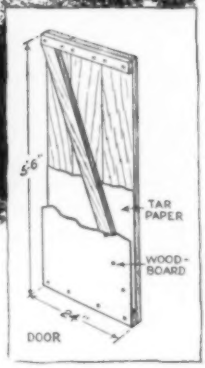
Pulling Rod and Pinch Bar Are Effective in Removing Valve Guides

Do not heat the work above a bare red heat when casehardening for colors, using cyanide.

Poultry Ranch Designed for the City Lot





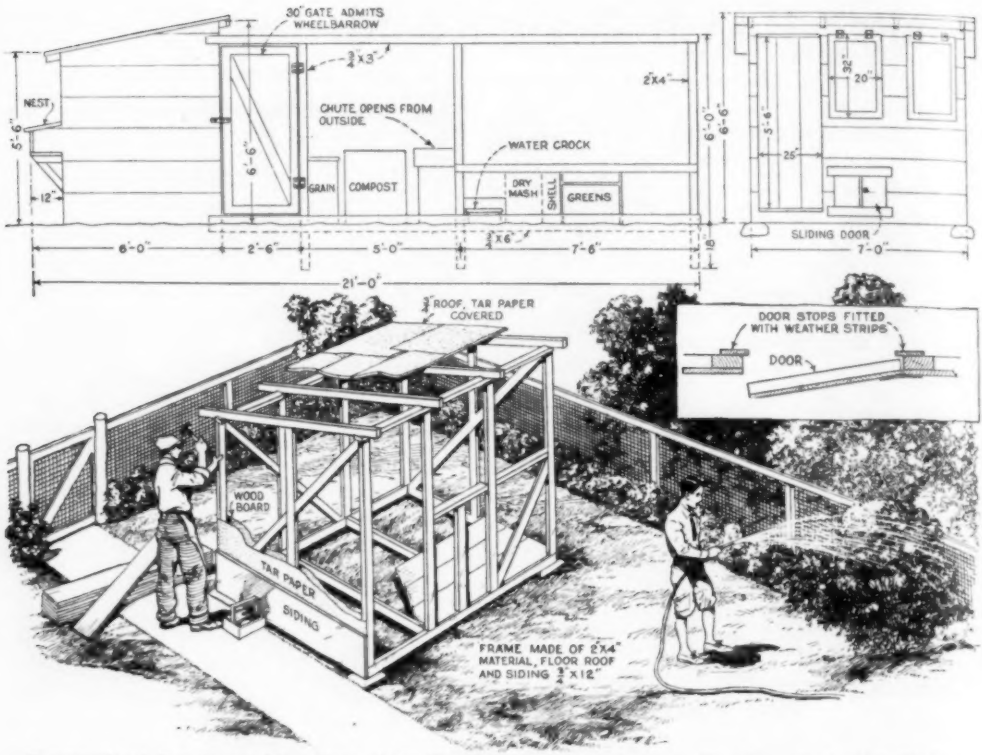


This Backyard Poultry House Measures Only Seven by Twenty-One Feet and Is Arranged to Make Possible Feeding the Hens without Entering the Run

By BOB HARDY

RAISING poultry on a small scale in the backyard is a very interesting diversion and keeps the table supplied with fresh eggs and tasty young fryers and broilers. The hens also solve the problem of disposal of most of the kitchen refuse, especially in the summer when there are so many melon rinds, vegetable parings, etc., turning this waste into eggs and meat. Lawn cuttings, weeds and the like are also valuable additions to the hen-house menu. At the same time the plant produces fertilizer which the home gardener will appreciate.

The construction of the hen house is clearly shown in the drawings. Although 2 by 4-in. stock is specified for all timbers, lighter stock can safely be used, as the framework is well braced. The bracing is important, for in high winds great havoc is wrought among poorly constructed hen houses. Build up the entire framework before laying the floor, and see that all studs are vertical, by using an improvised plumb line, consisting simply of a cord with a weight, nailed at the top of the stud or corner post so that it hangs about 1 in. from the timber. Corners of the floor frame should rest on large rocks or concrete blocks and must be absolutely level. If you have no level, a pan of water will do the trick. The siding specified is



Constructional Details and Dimensions of the Hen House and Run, Showing How Easy It Is to Build One; Vines and Shrubbery Can Be Used to Conceal It and Provide Shade

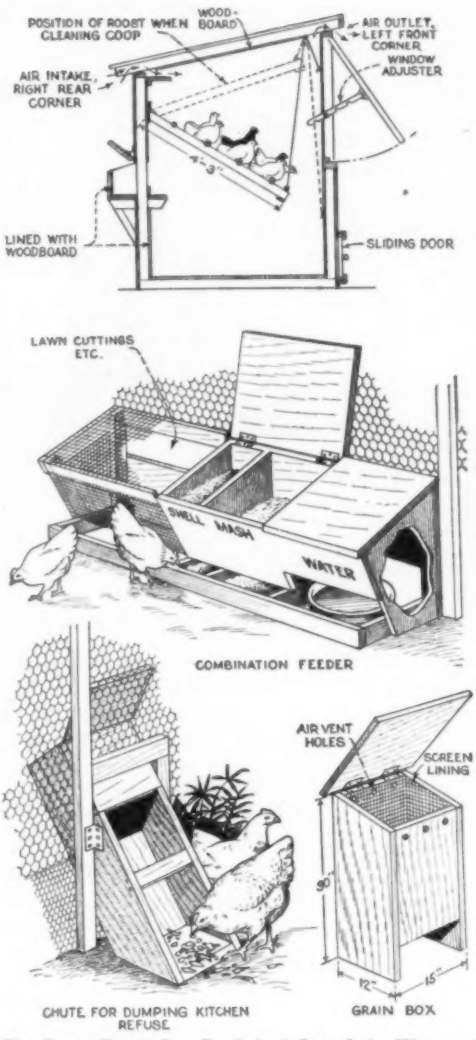
¾ by 12-in. yellow pine. The wood should be well seasoned, so that it will not shrink under the summer sun and leave cracks for rain to enter during the wet season. Tack tar paper, or building paper, to the framework before putting on the siding. The floor is of the same material as the siding. Woodboard, laid beneath it, will help to insulate the house against cold. Lay standard roofing paper over the roof boards, lapped as shown in the drawing, and cemented with roofing tar. Note that there is an extension on the rear side for the nests, which eliminates the necessity of entering the hen house to gather eggs. The extension is divided into five compartments, each about 12 in. square, for the laying nests, and the remainder of the space is partitioned off for tools, insect powder and other accessories. Install a woodboard lining before the partitions are set. A strip, about 3 in. wide, is nailed along the studs in front of the nests, to prevent straw from being spilled out. A shelf, about 8 in. wide, is also provided for the hens to alight on when hopping up to the nests. Seal the walls and ceiling tightly with woodboard. It makes a smooth interior which is easy to keep free of cobwebs and insects. A slot, about 3 in. wide and extending between two rafters, should be cut in the ceiling woodboard at the left rear corner and also the right front corner, for air circulation. Just below the intake slot, install an 8-in. board, as shown, to serve as a draft deflector, so that the cold air will not flow down directly on the hens. The roost frame consists of two 2 by 4-in. side members, supporting four roosting poles spaced about 12 in. apart. Round poles, about 1¼ in. in diameter, make very good roosts, but either square or rectangular poles will do, provided the corners are rounded. They should be fairly smooth and must be sprinkled occasionally with insect powder. The roost frame is hinged to the wall, as shown, and it should extend from one side of the house to the other with just enough clearance of the end members to allow their swinging up out of the way by means of cables.

Windows, about 20 by 32 in. in dimen-

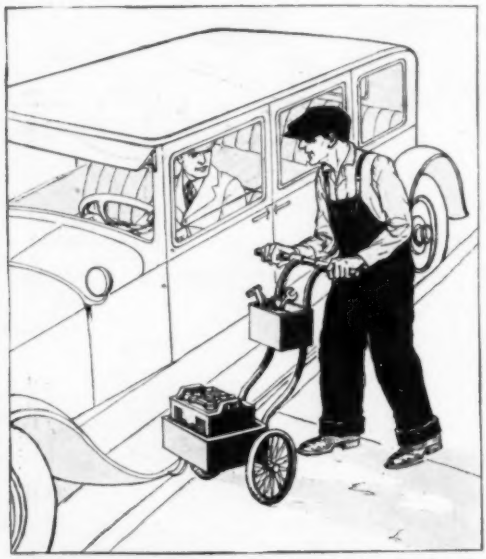
sions, admit plenty of sunlight, but other sizes will do as well, provided you alter the framework to fit them. They should be arranged to swing out in the daytime during fair weather, and should fit snugly against stops when closed with a dependable fastener. A notched stick, attached as shown, enables adjustment. In hot weather, they can be removed entirely or fitted with a cloth shade or standard window shade that can be pulled down over them. Weather strips along the stops of the door will keep out all drafts. A sliding door is provided for the poultry and should be kept closed on cold winter nights. The opening should be about 8 in. wide and 10 in. high. Building the outdoor run is a very simple job. The framework is built up of 2 by 4-in. posts with a 3-in. strip at the top and a 6-in. strip at the bottom. The latter is set halfway into the soil to prevent the hens from digging underneath. It is also a good idea to have the level of the poultry run 2 or 3 in. above the surrounding ground, so that it will drain off in wet weather. Fine wire mesh, 1 ft. wide, should be used at the bottom of the frame to keep the baby chicks in, and the remainder, as well as the top, should be covered with 2-in. screen mesh. The top really is covered to keep out prowling cats and also to keep in certain breeds, such as white leghorns, which otherwise could fly out easily. Make the gate about 30 in. wide, to admit a wheelbarrow for hauling out the compost. A weight on a cord over a pulley keeps the door closed.

The feed box has compartments for a water pan, dry mash, oyster shell and grit, and lawn cuttings. By having a roof over the box, feed and water are less likely to become fouled. One filling of shell serves a month or more. Lawn cuttings and other green food so necessary to egg production are supplied by a hopper made of 2-in. wire mesh, which can be filled from the outside of the pen. Grain is kept in a separate bin near the gate. This is built with the bottom a few inches above the ground and is lined with wire screen as a protection against mice and rats. The whole occupies only 7 by 21 ft. and can be concealed from view with vines.

Caring for the hens is a very simple matter and averages less than half an hour daily. Feeding costs are nominal; one handful of grain per fowl each day, and two other meals of table leavings, with grass or other green food added when available. A quarter's worth of cracked oyster shells will last two or three months. A hundred pounds of dry or laying mash, and 100 lb. of scratch grain will last about five weeks for 24 hens. Thus the total feed expense is less than $5 per month, while, on the other hand, the writer's hens produce close to four dozen eggs weekly the year around, and also provide meat for the table when desired, the older hens being replaced with younger ones.



The Roost Board Can Be Raised Out of the Way, and the Hoppers Are of the Self-Feeding Type



A Battery-and-Tool Truck for the Service Station Is Highly Convenient

Handtruck Carries Storage Batteries

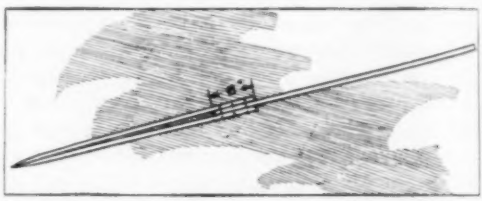
Instead of carrying storage batteries from his customers' cars to his shop for inspection or charging, the owner of a battery-service station uses a small handtruck. It is made from an ordinary cart axle fitted with wheels, and the handle, extending upward at an angle, can be made of wood or pipe. Two boxes are permanently attached to the truck, as shown, the lower one to hold batteries, and the upper one carrying all the tools necessary to remove, install and test batteries in the car. A suitable leg is provided so that the truck can be left standing without risk of tipping over while the battery is in a horizontal position. As the battery tools are at hand, the service man does not waste time on frequent trips to the shop for tools he has forgotten, which favorably impresses the customers.—K. M. Coggeshall, Webster Groves, Mo.

Improvised Pinion Made of Babbitt Metal

While doing some repair work in a remote mining camp, it was necessary to cut some threads on a lathe, and the only one available was in very poor condition. Some of the change gears had been lost, and among those was one that I needed for the job at hand. There was no milling machine so I could not cut a new pinion. The difficulty was overcome by improvising a pinion of babbitt metal. Setting up some change gears on their studs, I ran a strip of tin between them, the tin taking the shape of the teeth. I then turned a piece of wood to the right diameter and wrapped the tin around it leaving quite a portion projecting over the edge. The butting ends of the tin were carefully matched and it was then tied on, making a mold into which melted babbitt was poured. The resulting casting was drilled and a keyway cut. Although the teeth of this pinion were not exactly the shape desired, it did the work and saved the time it would have taken to send for another pinion.—M. L. Lowrey, Livermore, Calif.

Inexpensive Garden Poles

The problem of providing inexpensive yet satisfactory garden poles for pruned tomato vines, beans and the like, may be quickly solved by using a secondhand building lath. The upper part of the pole consists of a single lath, the lower 6 in. of it being straddled by two lath, which form the other half of the pole. The length will be about 6½ ft. The end where the two outside lath come together is planed to a point and the whole nailed together as shown, so that the pole can easily be driven into the ground.



Three Lath Nailed Together at the Center Make a Good Garden Pole

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